

# Operation and Installation Manual

## Advanced & M2B+ Microprocessor Controller

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Write Down Your Serial Numbers Here For Future Reference:

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_____	_____
_____	_____

We are committed to a continuing program of product improvement.  
Specifications, appearance, and dimensions described in this manual are subject to change without notice.

DCN No. \_\_\_\_\_

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# Shipping Information

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## *Unpacking and Inspection*

You should inspect your equipment for possible shipping damage. Thoroughly check the equipment for any damage that might have occurred in transit, such as broken or loose wiring and components, loose hardware and mounting screws, etc.

## *In the Event of Shipping Damage*

According to the contract terms and conditions of the Carrier, the responsibility of the Shipper ends at the time and place of shipment.

Notify the transportation company's local agent if you discover damage

Hold the damaged goods and packing material for the examining agent's inspection. **Do not return any goods before the transportation company's inspection and authorization.**

File a claim with the transportation company. Substantiate the claim by referring to the agent's report. A certified copy of our invoice is available upon request. The original Bill of Lading is attached to our original invoice. If the shipment was prepaid, write us for a receipted transportation bill.

Advise customer service regarding your wish for assistance and to obtain an RMA (return material authorization) number.

## *If the Shipment is Not Complete*

Check the packing list as back-ordered items are noted on the packing list. In addition to the equipment itself, you should have:

- Bill of lading
- Packing list
- Operating and Installation packet
- Electrical schematic and panel layout drawings
- Component instruction manuals (if applicable)

Re-inspect the container and packing material to see if you missed any smaller items during unpacking.

## *If the Shipment is Not Correct*

If the shipment is not what you ordered, **contact the shipping department immediately**. For immediate assistance, please contact the correct facility located in the technical assistance section of this manual. Have the order number and item number available. *Hold the items until you receive shipping instructions.*

### **Returns**

Do not return any damaged or incorrect items until you receive shipping instructions from the shipping department.

### **Credit Returns**

Prior to the return of any material, **authorization** must be given by **the manufacturer**. A RMA number will be assigned for the equipment to be returned.

Reason for requesting the return must be given.

ALL returned material purchased from **the manufacturer** returned is subject to 15% (\$75.00 minimum) restocking charge.

ALL returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

No credit will be issued for material that is not within the manufacturer's warranty period and/or in new and unused condition, suitable for resale.

### **Warranty Returns**

Prior to the return of any material, authorization must be given by **the manufacturer**. A RMA number will be assigned for the equipment to be returned.

Reason for requesting the return must be given.

All returns are to be shipped prepaid.

The invoice number and date or purchase order number and date must be supplied.

After inspecting the material, a replacement or credit will be given at **the manufacturer's** discretion. If the item is found to be defective in materials or workmanship, and it was manufactured by our company, purchased components are covered under their specific warranty terms.

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# Chapter 1: Safety

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## ***1-1 How to Use This Manual***

Use this manual as a guide and reference for installing, operating, and maintaining your equipment. The purpose is to assist you in applying efficient, proven techniques that enhance equipment productivity.

This manual covers only light corrective maintenance. No other maintenance should be undertaken without first contacting a service engineer.

The Functional Description section outlines models covered, standard features, and optional features. Additional sections within the manual provide instructions for installation, pre-operational procedures, operation, preventive maintenance, and corrective maintenance.

The Installation chapter includes required data for receiving, unpacking, inspecting, and setup of the equipment. We can also provide the assistance of a factory-trained technician to help train your operator(s) for a nominal charge. This section includes instructions, checks, and adjustments that should be followed before commencing with operation of the equipment. These instructions are intended to supplement standard shop procedures performed at shift, daily, and weekly intervals.

The Operation chapter includes a description of electrical and mechanical controls, in addition to information for operating the equipment safely and efficiently.

The Maintenance chapter is intended to serve as a source of detailed assembly and disassembly instructions for those areas of the equipment requiring service. Preventive maintenance sections are included to ensure that your equipment provides excellent, long service.

The Troubleshooting chapter serves as a guide for identification of most common problems. Potential problems are listed, along with possible causes and related solutions.

The Appendix contains technical specifications, drawings, schematics, and parts lists. A spare parts list with part numbers specific to your machine is provided with your shipping paperwork package. Refer to this section for a listing of spare parts for purchase. Have your serial number and model number ready when ordering.

## ***Safety Symbols Used in this Manual***

The following safety alert symbols are used to alert you to potential personal injury hazards. Obey all safety messages that follow these symbols to avoid possible injury or death.



***DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.***



***WARNING indicates a potentially hazardous situation or practice which, if not avoided, could result in death or serious injury.***



***CAUTION indicates a potentially hazardous situation or practice which, if not avoided, may result in minor or moderate injury or in property damage.***



## 1-2 Warnings and Precautions

Our equipment is designed to provide safe and reliable operation when installed and operated within design specifications, following national and local safety codes.

To avoid possible personal injury or equipment damage when installing, operating, or maintaining this equipment, use good judgment and follow these safe practices:



- Follow all **SAFETY CODES**.
- Wear **SAFETY GLASSES** and **WORK GLOVES**.
- Disconnect and/or lock out power before servicing or maintaining the equipment.
- Use care when **LOADING, UNLOADING, RIGGING, or MOVING** this equipment.
- Operate this equipment within design specifications.
- **OPEN, TAG, and LOCK ALL DISCONNECTS** before working on equipment. You should remove the fuses and carry them with you.
- Make sure the equipment and components are properly **GROUNDING** before you switch on power.
- When welding or brazing in or around this equipment, make sure **VENTILATION** is **ADEQUATE**. **PROTECT** adjacent materials from flame or sparks by shielding with sheet metal. An approved **FIRE EXTINGUISHER** should be close at hand and ready for use if needed.
- Refrigeration systems can develop refrigerant pressures in excess of 500 psi (3,447.5 kPa/ 34.47 bars). **DO NOT CUT INTO THE REFRIGERATION SYSTEM. This must be performed by a qualified service technician only.**
- Do not restore power until you remove all tools, test equipment, etc., and the equipment and related components are fully reassembled.
- Only **PROPERLY TRAINED** personnel familiar with the information in this manual should work on this equipment.

We have long recognized the importance of safety and have designed and manufactured our equipment with operator safety as a prime consideration. We expect you, as a user, to abide by the foregoing recommendations in order to make operator safety a reality.

## 1-3 Responsibility



These machines are constructed for maximum operator safety when used under standard operating conditions and when recommended instructions are followed in the maintenance and operation of the machine.

All personnel engaged in the use of the machine should become familiar with its operation as described in this manual.

Proper operation of the machine promotes safety for the operator and all workers in its vicinity.

Each individual must take responsibility for observing the prescribed safety rules as outlined. All warning and danger signs must be observed and obeyed. All actual or potential danger areas must be reported to your immediate supervisor.

# Chapter 2: Functional Description

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## ***2-1 Models Covered in This Manual***

This manual provides operation, installation, and maintenance instructions for the Advanced and M2B+ controller. The Advanced and M2B+ are available for use with several models of temperature control units (TCUs). A separate manual describes operation, installation, and maintenance instructions for the TCU itself.

## ***2-2 General Description***

The Advanced and the M2B+ are microprocessor-based process controllers designed for use with temperature control units. The Advanced and M2B+ monitor and maintain the temperature of the fluid in any given process to a selected setpoint using a unique proportional integral derivative (PID) auto-tuning program. The controller employs PID algorithms to automatically tune the system to heat or cool the fluid as required by the process.

The Advanced and M2B+ have a Liquid Crystal Display (LCD) that provides all operational status and programming menus. The controllers includes self- diagnostics to check hardware functions. All diagnostic information is displayed in the second line of the Liquid Crystal Display.

The Advanced and M2B+ are panel-mounted and have a membrane keypad with tactile feedback. When properly installed with a sealing gasket, the Advanced and M2B+ meet NEMA 4 or IP66 integrity.

### ***2-3 Standard Features***

- PID Control for both heating and cooling
- 4 line x 20 character LCD Display Screen
- Setpoint, To Process, From Process, and DT displays
- System status
- Password protection
- Selectable sensor types (Type K, J, & T thermocouples; 100 ohm and 1000 ohm RTDs)
- Autovent sequence (adjustable from 1 to 10 minutes)
- Sixteen segment Ramp/Soak program
- Start, stop, vent, and alarm silence switches
- D.C. dry contact inputs for pressure switch, pump rotation/phase loss, safety thermostat, second setpoint/remote start, weld contact, and for pump tank applications high and low water level
- Cascade control with remote input sensor
- Triac outputs for heating and cooling
- Crash (Quick) cool feature
- Alarm outputs for temperature (absolute and deviation), low or high flow (with optional flow meter), open temperature sensor, low water pressure, pump failure, over temperature, contactor weld, high and low water level (for pump tank units)
- Analog setpoint temperature input (current or voltage)

### ***2-4 Optional Features***

- Analog output for heating (SCRs) and cooling (modulating valves)
- Analog retransmission of Setpoint or To Process temperature
- Analog retransmission of flow (with optional flow meter)
- Flow sensor input, pulse or analog, with voltage excitation
- RS-232 or RS-485 Modbus communications
- RS-485 SPI communications

## ***2-5 Panel Layout and Keypad***

See Figure 1 on page 15 for an illustration of the control panel and its buttons. The LCD backlight lights up whenever any key is pressed. The backlight turns off after five minutes if no other key activity occurs.

### ***LED Indicator Lights***

The Advanced and M2B+ controller has one LED that will light up to indicate the control process has been started. This LED is located inside the Start button of the controller's front panel. When power is applied, the LED will remain off until the Start button is pushed. The LED will then illuminate green.

### ***LCD Display***

A 4-line by 20-character liquid crystal display (LCD) will show operational status, alarms and programming menus.

**1st Line.** The first line of the LCD continuously displays the 'To Process' temperature.

**2nd Line.** The second line of the LCD continuously displays the 'Setpoint' temperature.

**3rd Line.** The third line of the LCD continuously displays the 'From Process' temperature; the delta temperature of the 'To Process' and the 'From Process'; and the flow in GPM or LPM, if applicable.

**4th Line.** The fourth line of the LCD will display all menu items used in the controller setup. Also displayed are the status of the pump, outputs for the heater, as well as cooling and elapsed time for the vent cycle. The fourth line will also explain all alarm conditions and operating status.

### ***LCD Messages***

**Autotuning.** Appears while tuning is in process.

**High Water Alarm.** Appears if the option is selected and the switch is closed

**Water Pressure/Low Level Alarm.** Appears when the Low Water Pressure switch is open or the optional Low Water switch is closed.

**Auto Vent Indicator.** Appears in the LCD display when the unit is in Auto Vent mode. The vent time remaining will also be displayed.

**Pump Rotation/Loss Indicator.** Appears in the LCD display when the Pump Rotation switch is open.

**Safety Thermostat Indicator.** Appears in the LCD display when the Safety Thermostat switch is open.

**'To Process' Sensor Open Indicator.** "999" appears in the process LED displays when the 'To Process' probe is open.

**'From Process' Sensor Open Indicator.** "999" appears in the LCD display for return temperature (RT) when the 'From Process' probe is open.

**Remote Probe Sensor Open Indicator.** "999" appears in the LCD display for mold temperature (MT) when the Remote probe is open.

**High Alarm Indicator.** Appears in the LCD display when a High Alarm condition occurs.

**Low Alarm Indicator.** Appears in the LCD display when a Low Alarm condition occurs.

**‘From Process’ Temp Indicator.** Appears in the LCD display when the temperature display is showing the ‘To Process’ temperature.

**Delta Temp Indicator.** Appears in the LCD display when the temperature display is showing temperature differential.

**High Heat Output Indicator.** Displays status in the LCD display when full power heat output is applied.

**Low Heat Output Indicator.** Displays status in the LCD display when half power heat output is applied. When the optional proportional output is installed, the display will show the percentage of output.

**Cool Output Indicator.** Displays status in the LCD display when the cool output is applied. When the optional proportional output is installed, the display will show the percentage of output.

**Ramp/Soak Indicator.** Displays the ramp/soak segment status and remaining time in the LCD display.









**Second Setpoint/Remote Start.** Displays status in the LCD display when either function is selected.



**Communications Local/Remote.**

**Weld Contact.** Appears in the LCD Display when a Weld Contact Alarm condition occurs.

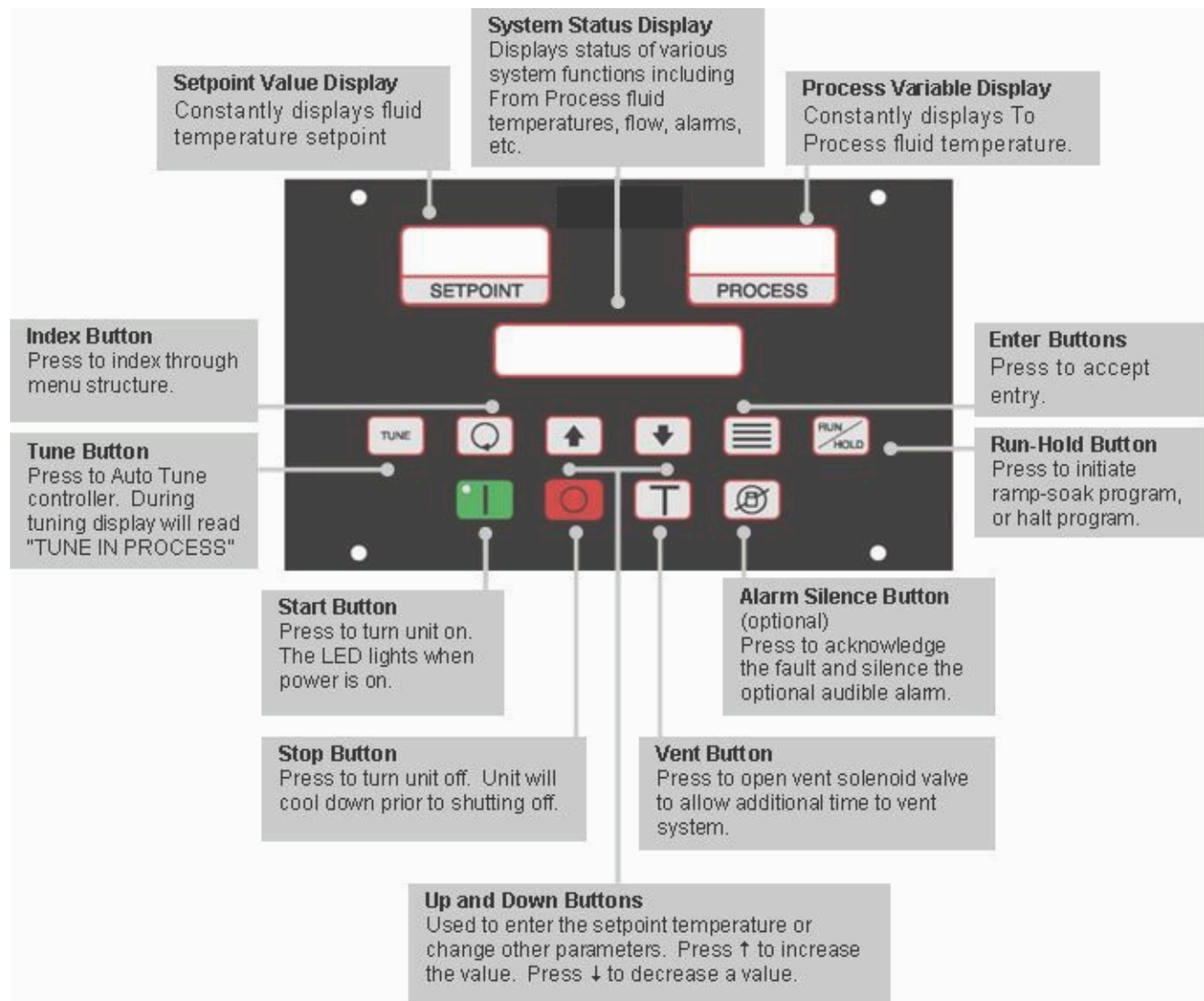
## Keypad

Four keys, ‘Index’, ‘Up’, ‘Down’, and ‘Enter’ are used primarily to gain access to the menu structure and modify the controller’s parameters and features. The remaining six keys are used to direct the controller to start or stop a process.

Button	Function
 Index	<ul style="list-style-type: none"> <li>Used to advance to one of the three setup menus.</li> <li>Used to advance to the next menu item when in a setup mode.</li> <li>Used in conjunction with the Down button to go back to a previous menu item when in a setup mode.</li> <li>Used in conjunction with the Enter button at power-on to break into Factory mode.</li> </ul>
 Up	<ul style="list-style-type: none"> <li>Used to increment the current setpoint value while system is in the normal running mode. Note that the rate speeds up when the key is held down.</li> <li>Used to increment the current parameter value when in a setup mode. Note that the rate speeds up when the key is held down.</li> <li>If pressed when the oil unit is in the “PmpRev” Shutdown mode, the Vent Output and the Alarm2 Output will be energized while the key is pressed. Use this function to reverse the pump in order to purge the mold of hot oil.</li> </ul>
 Down	<ul style="list-style-type: none"> <li>Used to decrease the current setpoint value while the system is in the normal running mode. Note that the rate speeds up when the key is held down.</li> <li>Used to decrease the current parameter value when in a setup mode. Note that the rate speeds up when the key is held down.</li> <li>If pressed when the Index button is being held down, returns to the previous menu item when in a setup mode.</li> </ul>
 Enter	<ul style="list-style-type: none"> <li>Used to select one of the three setup modes.</li> <li>Used to accept (save/write to EEPROM) the current indicated parameter value.</li> <li><b>Note:</b> No save/write occurs unless the Enter key is pressed before going to the next/previous item or Setup mode is terminated.</li> <li>Used in conjunction with the INDEX key at power-on to enter into the Factory mode.</li> </ul>
 Tune	<ul style="list-style-type: none"> <li>If no Autotune operation is in progress, this button starts an Autotune operation. If an Autotune operation is in progress, pressing this button will immediately stop the Autotune operation. While the Autotune is running, the “Autotune” message is displayed on the LCD in place of the normal “Running” message.</li> <li>This key will not function if the Security Level is less than 3.</li> <li>This key will not function if the Ramp/Soak operation is in progress.</li> <li>This key will not function while in the Factory mode.</li> </ul>
 Run/Hold	<ul style="list-style-type: none"> <li>This key controls the Ramp/Soak process. If no Ramp/Soak operation is in progress, it starts the Ramp/Soak operation. When Ramp/ Soak is running, this key puts the Ramp/Soak operation into a hold condition. While the Ramp/Soak is running, the “Ramp/Soak” message is displayed on the LCD in place of the normal “Running” message.</li> <li>This key will not function if the Security Level is less than 3.</li> <li>This key will not function if the Ramp/Soak operation is in progress.</li> <li>This key will not function while in the Factory mode.</li> </ul>
 Start	<ul style="list-style-type: none"> <li>When system is powered-on, the controller initializes and then displays the “[SYSTEM OFF]” message on the LCD. The controller is not functioning at this point. Pressing this START key enables all controller functions and lights the green power-on LED. After the system has been started, the “[Running]” message is displayed on the LCD.</li> </ul>
 Stop	<ul style="list-style-type: none"> <li>Stops all controller functions and turns off the green power-on LED (overrides Remote Start input). After the system has been stopped, the “Stopped” message is displayed on the LCD.</li> <li>This key will override an existing Remote Start input switch closure.</li> </ul>

Button	Function
 <b>Vent</b>	<ul style="list-style-type: none"> <li>When the system is first powered-on and the "Power Available - System Off" message is displayed, pressing the VENT key will turn on the Vent Output for a period of 8 seconds. The message "VENT" will be displayed during this period.</li> <li>When the system is running, pressing the VENT key shall manually turn on the Vent Output for as long as the key is held down, provided the 'To Process' temperature is below 150°F (65.5°C) for a water unit and 250°F (121°C) for an Oil unit. The message "Vent Time = MANUAL" will be displayed while the key is held down.</li> </ul>
 <b>Alarm Silence</b>	<ul style="list-style-type: none"> <li>Turns off the Alarm 1 Output. The cause of the alarm will continue to appear in LCD until the fault is cleared.</li> <li>Used to immediately terminate any of the three Setup modes without having to cycle through to the end of the menu items. Note that the current displayed parameter value is not saved to EEPROM when this key is pressed.</li> <li>Can be used as a means of turning on the LCD backlight without affecting any operation.</li> </ul>

**Figure 1: Panel Layout**



## ***2-6 Menu Structure***

The parameter menu structure is organized into three basic menus: Primary, Secondary, and Secure. To access the menus, press the Index button until the menu label appears in the second line of the LCD display. Additional menus display when an option is selected; however, the options are non-functional unless the appropriate menu option or option board has been installed. See the Menu Parameter Tables in the Appendix of this manual for more information.

Continuing to press the Index button scrolls from menu to menu. Press the Enter button to enter the menu, and use the Index button to scroll through the parameters of the menu. Once you find the parameter that needs to be changed, use the Up and Down buttons to change the parameter. Press the Enter button to accept the new value.

You can exit the setup menus by scrolling through the menu to its end or by pressing the Alarm Silence button. The controller will automatically exit the setup menu if no buttons have been pressed for more than one minute.

### ***Primary Menu***

The Primary menu includes all non-critical parameters for standard operation including but not limited to standby mode, mold temperature, alarm trip points, ramp/soak settings, and high heat.

### ***Secondary Menu***

The Secondary menu includes all non-critical parameters for optional equipment including but not limited to degrees F/C, Alarm parameters, ramp/soak segments, remote setpoint scaling, communication setup, and retransmission scaling.

### ***Secure Menu***

The Secure menu includes all critical parameters for setting up the controller including but not limited to controller function, select either Water TCU or Oil TCU default values, flow meter on/off, remote control probe on/off, pressure switch, high and low level, safety thermostat on/off, output parameters, and scale limits.



## 2-7 Passwords and Security

The controller provides four levels of security. Depending on the security level, some or all of the setup menus may be locked. The security level must be changed in order to unlock these menus. The current security level is displayed in the lower right corner of the menu display. The default security level is 3.

Security levels are changed by changing the password value using the Up and Down buttons and pressing the Enter button. Values in the setup menus can be changed only when the correct security level is set. Note that the security level value itself can be changed in any security level.

Use the following procedure to change the security level:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button. The LCD screen will display the current security level.
3. Use the Up or Down buttons to change the value in the display line to the password of the new desired security level.
4. Press the Enter button to select this new security level and retain the value in EEPROM. The display will change from the password value to the selected security level for that password.

Level	Password	Menu	Status	Description
1	110	Primary	Locked	No parameter values can be changed. Setpoint can be changed. Alarm silence button active.
		Secondary	Locked	
		Secure	Locked	
2	101	Primary	Unlocked	Only the primary menu values can be changed. Setpoint can be changed.
		Secondary	Locked	
		Secure	Locked	
3	011	Primary	Unlocked	Only the primary and secondary menu values can be changed. Setpoint can be changed.
		Secondary	Unlocked	
		Secure	Locked	
4	111	Primary	Unlocked	All parameter values can be changed. Setpoint can be changed.
		Secondary	Unlocked	
		Secure	Unlocked	



## Chapter 3: Installation

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### ***3-1 Location***

Mount the instrument in a location that will not be subject to excessive temperature, shock or vibration. All models are designed for mounting in an enclosed panel.

When properly mounted in an enclosed panel using a gasket at the panel/controller interface, the keypad can be washed down with water. Do not use high-pressure fluids.

### ***3-2 Electrical Connections***

Microprocessor-based instruments require a “clean” source of power that is steady and free of noise. Electrical noise may be caused by line faults, power switching, motors, motor controllers, or power controllers containing SCR devices. Without a clean source, any microprocessor is prone to failure. If your power source is not from a clean line, your system can be protected by installing a line filter.

Where external contactors or solenoids are used with relay output instruments, an R/C Snubber Network should be used. The snubber installs easily directly across the field coil terminals of the relay or solenoid.

Do not run thermocouples, RTD's or other class 2 wiring in the same conduit or area as the power leads. Maintain separation between wiring of sensors, process signals and other power and control wiring.



# Chapter 4: Basic Operation

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## ***4-1 Turning the Power On***

When AC power is first applied to the unit, the following sequence of events will occur:

1. The LCD backlight lights up.
2. The LCD displays dashes: LEDs have all segments on.
3. The LCD displays the PROM Rev/Date.
4. The LCD displays “SelfTest in Progress.”
5. If the ‘Debug’ parameter is enabled, the following messages about Option Cards can be displayed:
  - Re-Transmit Detected
  - Cool Analog Detected
  - Heat Analog Detected
  - Serial Comm Detected
  - None Installed
6. The LED segments turn off.
7. The LCD backlight turns off.
8. The LCD displays “Power Available/System OFF.”

At this point, a Manual Vent Operation can be initialized for 8 seconds by pressing the Vent button.

The unit is now in a standby mode of operation. No system process control will occur until the Start button is pressed.

## 4-2 Starting and Stopping Water TCUs

### *Starting the Unit (Local)*

Press the Start button to begin the following sequence of events:

1. The green LED inside the Start button lights up.
2. The LCD backlight lights up.
3. The Pump Output turns on.
4. The LCD displays the setpoint value, process temperature, return temperature, and delta temperature.
5. If the Auto Vent Cycle parameter is enabled, the Vent Output turns on, and the LCD displays “Vent Time = mm:ss.”
6. When the Auto Vent timer expires or if the Auto Vent Cycle parameter is disabled, the LCD displays “RUNNING,” and system control begins.

### *Stopping the Unit*

While the system is running, press the Stop button to shut down the system. If the process temperature is below 150°F, the system will immediately shut down. If the current process temperature is above 150°F, pressing the Stop button will begin the following sequence of events:

7. The LCD displays “SHUTDOWN [Cool Down].”
8. The setpoint changes to 150°F.
9. The Heat Outputs will turn off.
10. The Cool Output will turn on.
11. The system waits for the process temperature to drop down to 150°F.

#### **NOTICE**

*Shutdown temperature is adjustable from 90°F to 180°F. See Section 5-14 for procedure.*

12. At 150°F, the LCD displays “SHUTTING DOWN.”
13. All outputs immediately turn off.
14. The system re-cycles to the “Power Available/System OFF” state.

#### **NOTICE**

*Pressing the Stop button a second time while the controller is in the “SHUTDOWN [Cool Down]” mode will abort this cool down operation and the system will immediately go into the “SHUTTING DOWN” phase of the operation.*

### *Starting the Unit (Remote)*

REMOTE START option, the controller start sequence will be initiated by a maintained dry contact closure on pins 5 & 6 of header J6. The controller may be turned off by two means; open the maintained contact input or depress the controller stop button.

The controller may also be started or stopped locally by depressing the controller start button or stop buttons.

## 4-3 Starting and Stopping Hot Oil TCUs

### *Starting the Unit (Local)*

Press the Start button to begin the following sequence of events:

1. The green LED inside the Start button lights up.
2. The LCD backlight lights up.
3. The Pump Output turns on.
4. The LCD displays the setpoint value, process temperature, return temperature, and delta temperature.
5. If the Auto Vent Cycle parameter is enabled, the Vent Output turns on, the green LED blinks, and the LCD alternates between “Mode is OFF,” “Press START to Run,” and “Vent Time = mm:ss.”
6. When the Auto Vent timer expires or if the Auto Vent Cycle parameter is disabled, the LCD alternates between “Mode is Off” and “Press START to Run.”
7. Press the Start button. The display reads “Vent Time = mm:ss.”
8. When the vent time expires, the LCD displays “RUNNING,” and system control begins.

### *Stopping the Unit*

While the system is running, press the Stop button to shut down the system. If the current process temperature is above 150°F, pressing the Stop button will begin the following sequence of events:

9. The LCD displays “SHUTDOWN [Cool Down].”
10. The setpoint changes to 150°F.
11. The Heat Outputs will turn off.
12. The Cool Output will turn on.
13. The system waits for the process temperature to drop down to 150°F.

#### **NOTICE**

*Shutdown temperature is adjustable from 90°F to 180°F. See Section 5-14 for procedure.*

14. At 150°F, the LCD displays “SHUTTING DOWN.”
15. All outputs immediately turn off.
16. The system re-cycles to the “Power Available/System OFF” state.

#### **NOTICE**

*Pressing the Stop button a second time while the controller is in the “SHUTDOWN [Cool Down]” mode will abort this cool down operation and the system will immediately go into the “SHUTTING DOWN” phase of the operation.*

If the process temperature is below 150°F, all outputs will turn off, and the controller will enable Pump Reverse mode. The LCD will display “Shutdown [PmpRevOff]” for 30 seconds before the system re-cycles to the “Power Available/System OFF” state.

During the 30-second “Shutdown[PmpRevOff] mode, press the Up button to reverse the pump and purge oil from the mold. During pump reverse, the Vent Output and Pump Reverse outputs will turn on. The LCD will display “Shutdown[PmpRevON] until the Up

button is released, at which time the 30-second time-out will restart. After 30-seconds, the system will recycle to the “Power Available/System OFF” state.

### ***Starting the Unit (Remote)***

REMOTE START option is similar to the water process sequence. Closure of pins 5 and 6 of header J6 initiates the start sequence. The display flashes MODE IS OFF, PRESS START TO RUN. THE VENT/FILL timer counts down from 10 minutes. After the VENT/FILL timer has elapsed, the controller will automatically go to the second vent operation for 10 minutes. Upon completing the second vent operation the controller will automatically go to the run mode.

The controller may also be started or stopped locally by depressing the controller start button or stop buttons.

## **4-4 Tuning**

### ***Autotuning***



***The factory default for the controller is automatic half/full heat for water units, and full heat for oil units. If an autotune cycle is completed, do not switch to low heat without performing a new autotune cycle. Failure to autotune will result in poor control of the process. Subsequent changes from one heat setting to another require autotune to be run.***

The Tune button is used to toggle the autotune process. If no autotune operation is in progress, pressing the Tune button starts the autotune operation. The “AutoTune” message is displayed on the LCD. If an autotune operation is already in progress, pressing this button again will immediately stop the autotune operation. The display will return to the “Running” message.

During the autotune process, the control point is the ‘To Process’ probe or the ‘Remote Selected’ probe. The tuning constants (i.e. rate, reset and gain) can be altered in setup mode.

The unit’s cycle time is selectable in one-second increments. The heat and cool cycles have a minimum pulse of one second.



### ***Manual Tuning (Zeigler-Nichols PID Method)***

This tuning method may be used if the spread between ambient temperature and process operating temperature is small. For best results, use a recording device when tuning with this method.

1. Disable the cooling valve by removing the output signal to the device. For solenoid valves, remove plug from the solenoid. For modulating valves, remove the J7 plug located on the back of the controller.
2. Press the Index button one time to access the Primary Menu.
3. Press the Enter button.
4. In the Primary Menu, change the Reset Time and Rate Time OFF, and change the Prop Band Heat to 100.
5. Adjust setpoint to the desired value.
6. While monitoring the process temperature or recording device, decrease the proportional value by repeatedly halving the value until a small, sustained temperature oscillation is observed. Measure the period of one cycle of oscillation "T".
7. Divide the period of oscillation "T" by eight; the resulting number is the correct Rate Time in seconds.
8. Multiply the Rate Time by four. This is the correct Reset Time in seconds.
9. Multiple the bandwidth value "T" by 1.66, and enter this as the new Prop Band Heat value.
10. Re-enable the cooling valve by reversing step 1.

### ***4-5 Selecting a Local Probe***

The controller has two standard temperature probe inputs for delivery (to process) and return (from process). The probes are typically set up at the factory, but they can be re-configured in the field. To set up this feature you must have access to the Secure Menu. See Section 2-6 on page 16 to review accessing the Secure Menu.

Use the following procedure to select a local probe:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads "Sensor type = RTDIK."
4. Use the Up and Down buttons to select the sensor type.
5. Press the Enter button to accept the value.

When changing the sensors from RTDs to thermocouples, you must also change the jumpers JMP1 and JMP3 to pins 2 and 3.

6. Press the Alarm Silence button to return to Running mode.

### ***Using a Remote Input Probe for Monitoring***

The Remote Probe Input can be used for two different functions: To control or monitor the temperature of a process outside of the temperature control loop. To set up this feature you must have access to the Secure Menu. See Section 2-6 on page 16 to review accessing the Secure Menu.

This option can be purchased with or without the manufacturer supplying the actual temperature-sensing device. If the manufacturer supplies the probe, the controller is preconfigured, and the user needs to set up the controller as local or remote input.

Use the following procedure to monitor the process from the remote probe:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads "Sensor Monitor."
4. Press the Enter button.
5. Use the Up and Down buttons to select the type of input desired. Select "MON" for monitor. The LCD display will change to have MT display the monitored temperature from the probe.  
If the display reads "999," the probe is not plugged into the back of the controller at pins 3 and 4 of the 8-pin connector.
6. Press the Enter button to save the sensor monitor parameter.
7. Press the Index button until the display reads "Mold Sensor Type."
8. Press the Enter button.
9. Use the Up and Down buttons to select the type of mold sensor (Type J, K, or T thermocouples or 100 or 1000 ohm RTD).
10. Press the Enter button to save the mold sensor type.
11. Press the Alarm Silence button to return to Running mode.

## ***4-6 Setting Up Cascade Control***

The controller is provided with an internal cascade control feature. Cascade control is used to enable a process having multiple lags to be controlled with the fastest possible response to process disturbances. The system uses a remote control probe in the downstream process and a local delivery and return probe in the TCU. The controller uses the remote probe to drive the heating and cooling outputs, while the local delivery probe is the process fluid temperature limit control. To set up this feature you must have access to the Secure Menu. See Section 2-6 on page 16 to review accessing the Secure Menu.

### **V1.09C-V2.01 Cascade Set-up**

- Turn Power on. The controller will go through an initialization sequence.
- After the sequence is complete, turn the controller on with the start button. The controller will be defaulted to SECURE 3; To access parameters in the secure menu the controller must be in SECURE 4.
- Index to secure menu, press enter, Use the up arrow to scroll to “111”, press enter. The controller secure menu is unlocked.
- Scroll down to the SENSOR MONITOR menu, default is OFF. Depress the up arrow to display=CNTL depress enter. The controller is now set for cascade control.
- Scroll to the menu MOLD SENSOR type. Press the up arrow to display = RTD. This is the setting for a 100 ohm RTD for the remote probe. For 1K ohm, select RTD1K.
- Continue to scroll through the menu until the control goes back to the run menu. Or wait one minute without touching a key. The controller will return to the run mode automatically.
- The remote probe input is wired to Header J5, pins 3 and 4 on the back of the controller. The remote probe is factory defaulted for a Type J T/C input. Move the jumper “JMP2” to pins 1 and 2 for a RTD input.
- The controller process display will reflect the customer’s remote temperature. DT (local to process temperature) will appear to the right of the Delta T temperature.
- If the local PID parameters are known, enter them for the inner loop parameters. If they are unknown, take the controller out of the cascade mode by setting the SENSOR monitor selection to OFF. Press the TUNE button. The parameters will be written into the primary menu.
- Return the controller to the cascade mode.
- Press the TUNE button again to tune the controller to the customer’s process. When the tune is completed, the PID parameters will be written into the PRIMARY menu.
- Both the inner and outer loops can be viewed or adjusted in the PRIMARY menu.

#### ***4-7 Adjusting the Automatic Venting Timer***

When the Auto Vent Cycle Timer is set, the controller will open the venting valve for the set time at the startup of the unit. The Auto Venting Timer can be turned off, or it can be set to a specified time period. For water TCUs, Auto Vent can be set between 1 and 10 minutes. For hot oil TCUs, the vent time can be set between 1 and 60 minutes. TCUs are programmed at the factory to Auto Vent for 1 minute for water units and 10 minutes for oil units.

Use the following procedure to adjust the Auto Vent Cycle parameter:

1. Press the Index button one time to access the Primary menu.
2. Press the Enter button.
3. Press the Index button until the display reads "Auto Vent Cycle."
4. Press the Enter button.
5. Use the Up and Down buttons to set the cycle time to the desired time.
6. Press the Enter button to save the cycle time.
7. Press the Alarm Silence button to return to Running mode.

#### ***4-8 Using Crash Cool***

The Crash Cool feature allows the user to quickly cool the process down. Once Crash Cool is turned on, the setpoint is automatically adjusted to 0°F, and the cooling valve is opened. Oil TCUs not equipped with the optional heat exchanger will cool only through convection and radiation.

Use the following procedure to being "Crash Cool":

1. Press the Index button one time to access the Primary menu.
2. Press the Enter button
3. Press the Index button until the display reads "Crash Cool."
4. Press the Enter button.
5. Use the Up and Down buttons to set the "Crash Cool" parameter to "ON."
6. Press the Enter button to begin crash cooling. The setpoint will change to 0, and the cool output will turn on.
7. Press the Alarm Silence button to return to Running mode.

# Chapter 5: Advanced Operation

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## 5-1 Using the Analog Remote Input

This feature is typically setup at the factory, but can be installed as a retrofit in the field. It is used to accept a remote analog setpoint value or flow value. If the analog signal is set up for remote setpoint input, the Up and Down arrow keys are locked out for changing the setpoint at the controller. The analog signal can be configured to be 0-20 mA, 4-20 mA, 0-5 VDC, 1-5 VDC, 0-10 VDC, or 2-10 VDC via jumper 4 and menu selection.

### CAUTION

*When two or more electrical devices are connected to a common ground through different paths a difference in potential between ground sources causes current to flow within the interconnecting wiring, and could potentially damage either or both devices. An optical isolator is recommended for these instances and ACS Group offers this as an option when it is known that a PLC will be generating the analog signal.*

Use the following procedure to set up the Analog Remote Input:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Remote Input.”
4. Press the Enter button.
5. Use the Up and Down buttons to change value to either SETP for setpoint or FLOW for flow.
6. Press the Enter button.
7. Press the Index button one time to access the “Remote Signal” parameter.
8. Press the Enter button.
9. Use the Up and Down buttons to change the range of the analog input.
10. Press the Enter button.
11. Press the Alarm Silence button to return to Running mode.

From the factory, the remote setpoint temperature range is set up to be the same as the range of the controller (Water: 0°F to 250°F; Oil: 0°F to 550 °F). These parameters can be changed through the Secondary Menu.

Use the following procedure to adjust the remote setpoint temperature range:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Remote SetPtLo” for the low limit, or “Remote SetPtHi” for the high limit.
4. Press the Enter button.
5. Use the Up and Down buttons to change the value.
6. Press Enter to accept the value change.
7. Press the Alarm Silence button to return to Running mode.

### NOTICE

*If there is no signal present, the controller’s setpoint will automatically default to 0 °F.*

## 5-2 Retransmission Analog Signal

This feature is typically set up at the factory, but it can also be installed as a retrofit in the field. It is used to transmit an analog signal for process temperature, setpoint temperature, and flow. The analog signal can be configured to be 0-20mA, 4-20mA, 0-5VDC, 1-5VDC, 0-10VDC, and 2-10VDC.

### NOTICE

*The Process Output Low and High values must match the high and low limits of the controller setup in the Secure menu.*

Use the following procedure to set up the analog retransmission output:

1. Insert the analog retransmission card (P/N 691-00537-00) into header “J9.” The card must be inserted into the header to activate the analog output setpoint menus.
2. Press the Index button two times to access the Secondary menu.
3. Press the Enter button.
4. Press the Index button until the display reads “Analog Out=Process Signal Type.”
5. Use the Up and Down buttons to change the value.
6. Press the Enter button to accept the value.
7. Press the Index button until the display reads “Process Outflow.”
8. Use the Up and Down buttons to change the low limit value.
9. Press the Enter button to accept the value.
10. Press the Index button until the display reads “Process OutHig.”
11. Use the Up and Down buttons to change the high limit value.
12. Press the Enter button to accept the value.
13. Press the Index button until the display reads “Process Out SrC.”
14. Use the Up and Down buttons to change the analog signal source to PROC, SETP, or FLOW.

### NOTICE

*Selecting “FLOW” requires additional setup. See the next procedure.*

15. Press the Enter button to accept the value.
16. Press the Alarm Silence button to return to Running mode.

### ***Setting the Analog Signal Source to FLOW***

If the analog signal source is set to “FLOW,” follow steps 1 through 15 on page 30, and then complete the following procedure:

1. Press the Index button until the display reads “Remote Input.”
2. Use the Up and Down buttons to change the value to “FLOW.”
3. Press the Enter button to accept the value.
4. Press the Index button until the display reads “Remote Signal.” Do not alter this value; use the default setting.
5. Press the Enter button to accept the default setting.
6. Press the Index button until the display reads “Remote Flowslo=Minimum Flow Value.”
7. Use the Up and Down buttons to change the value to 0.
8. Press the Enter button to accept the value.
9. Press the Index button until the display reads “Remote Flowshi=Maximum Flow Value.”
10. Press the Enter button to accept the default value.
11. Press the Alarm Silence button to return to Running mode.
12. Press the Index button two times to access the Secondary menu.
13. Press the Enter button.
14. Press the Index button until the display reads “Remote Input.”
15. Use the Up and Down buttons to select “OFF.”
16. Press the Enter button to accept the value.
17. Press the Alarm Silence button to return to Running mode.

### ***Using Analog Output for Heating and Cooling***

This feature is typically set up at the factory, but it can also be installed as a retrofit in the field. It is used to control a modulating valve or heating SCR proportionally. The analog signal can be configured to be 0-20mA, 4-20Ma, 0-5VDC, 1-5VDC, 0-10VDC, and 2-10VDC. Inserting the card into header “J5” for cooling or “J6” for heating automatically configures the controller to direct its outputs through these boards.

Use the following procedure to set up the analog outputs:

1. Insert the analog card (P/N 691-00537-00) into the appropriate header.
2. Press the Index button two times to access the Secondary menu.
3. Press the Enter button.
4. Press the Index button until the display reads “Cool Output” or “Heat Output.”
5. Use the Up and Down buttons to select the analog signal type.
6. Press the Enter button to accept the value.
7. Press the Alarm Silence button to return to Running mode.

### 5-3 *Using the Flow Monitor*

The controller is set up to accept a pulsed or current input from a flow sensor. The controller translates the pulse or current into either gpm (gallons per minute) or lpm (liters per minute). If the flow sensor is of the pulsed variety, it is connected to block J1 on the main controller board. For analog signal sensors, see Section Chapter 5: on page 29.

Use the following procedure to set up a pulsed flow sensor:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Flow Monitor.”
4. Press the Enter button.
5. Use the Up or Down buttons to change the value to PUL for pulsed input.
6. Press the Enter button to accept the value.
7. Press the Index button one time to access the “Flow Constant B” parameter.
8. Press the Enter button.
9. Use the Up and Down buttons to change the offset of the displayed flow reading.  
This value should be determined by using a certified sensor to determine the offset.
10. Press Enter to accept the value.
11. Press the Index button one time to access the “Flow Constant K” parameter.
12. Press the Enter button.
13. Use the Up and Down buttons to change the scaling factor to the K factor (pulses per gallon) provided by the sensor manufacturer. If the K factor isn’t known, use the GPM flow rate and frequency. (A factor = GPM/Hz, K factor = 60 sec./A factor)
14. Press the Enter button to accept the value.
15. Press the Alarm Silence button to return to Running mode.

At this point, the controller should display the flow as “FL=X.X.” The user can now set up as many as two alarms that will annunciate when the flow drops below or rises above a set value.

Use the following procedure to set up the flow alarm:

1. Press the Index button one time to access the Primary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Flow Alarm Low” for a low flow alarm or “Flow Alarm High” for a high flow alarm.
4. Press the Enter button.
5. Use the Up and Down buttons to change the value.
6. Press the Enter button to accept the value.
7. Press the Alarm Silence button to return to running mode.

Use the following procedure to change the units of the displayed flow:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Flow Display.”
4. Press the Enter button.
5. Use the Up and Down buttons to change the value between GPM and LPM.
6. Press the Enter button to accept the change.
7. Press the Alarm Silence button to return to Running mode.



## 5-4 Programming the Alarms

The controller is set up to monitor both critical and non-critical operations within the process. Based on the severity of the condition, the controller will alarm and perform a specific function based on the type of unit being controlled. If an alarm is tripped, the LCD display will flash the backlight and if an audible alarm is present, turn it on. Below is a brief explanation of each of the eight areas that the controller monitors and how to set them up.

### Temperature

This alarm is used to monitor the difference between the setpoint and the “to process” temperatures. The alarm can be configured as an absolute or deviation alarm. When setting the alarm value for an absolute alarm (Alarm1 Mode = ABS), simply set the value at which the alarm is to occur.

When setting the value for the deviation alarm (Alarm1 Mode = DEV), set the difference in value from the Setpoint desired. For example if you want to configure Alarm 1 as a high and low deviation alarm (Alarm1 Cfg = HILO and Alarm1 Mode = DEV), and you want the low alarm to be 5 degrees below the setpoint, then set Alarm 1 Low = 5. If a high alarm is to be 20 degrees above the setpoint, then set Alarm 1 High = 20. If the setpoint is changed, the alarm will continue to maintain that deviation.

Use the following procedure to set up the temperature alarm to be either an absolute alarm or a deviation alarm:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Alarm1 Cfg.”
4. Press the Enter button.
5. Press the Up and Down buttons to select the alarm type: low, high, hilo, or evnt.
6. Press the Enter button.
7. Press the Index button one time to see “Alarm1 Mode.”
8. Use the Up and Down buttons to select ABSL for absolute or DEV for deviation.
9. Press the Enter button.
10. Press the Alarm Silence button to return to the Running mode.
11. Press the Index button one time to access the Primary menu.
12. Press the Enter button.
13. Press the Index button until the alarm type you selected in Step 5 appears (example Alarm 1 Low).
14. Press the Enter button.
15. Use the Up and Down buttons to select the temperature for the configured alarm.
16. Press the Enter button.
17. Repeat Steps 15 and 16 until all of the alarm configurations are set up.
18. When finished, press the Alarm Silence button to return to Running mode.

### NOTICE

*The factory setup of the alarms is to be in an On/Off reset mode (Alarm1 Reset = ONOF). The reset declares how the controller is supposed to function when the alarm is tripped. The On/Off mode allows the controller to reset the alarm when the offending parameter is cleared. The HOLD mode makes the alarm a critical one in which the user has to turn the controller off and then on to clear the alarm.*

## ***Flow Alarm***

This alarm is used to monitor the flow rate input from either a pulse or analog style flow meter. Once the Flow Monitor is turned on (in the Secure Menu; Flow Monitor = PUL or CUR) either a low flow alarm or high flow alarm or both can be set up.

Use the following procedure to set up the Flow Alarm:

1. Press the Index button one time to access the Primary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Flow Alarm Low.”
4. Press the Enter button.
5. Use the Up and Down buttons to adjust the value of the alarm.
6. Press the Enter button to accept the value.
7. Press the Index button until the display reads “Flow Alarm High.”
8. Press the Enter button.
9. Use the Up and Down buttons to adjust the value of the alarm.
10. Press the Enter button to accept the value.
11. Press the Alarm Silence button to return to Running mode.

## ***Open Sensor***

This alarm occurs when the controller loses the signal from the To Process (process display 999), From Process (return display 999), or Remote probes (mold display 999). This alarm is critical. The pump will remain operating and cooling is enabled. Turn the controller off, correct the condition and start the controller to clear the fault. There are no menu items that affect this function.

## ***Low Pressure***

This alarm occurs when the controller loses the signal from the pressure switch. In water units, this alarm immediately disables the pump motor, heat, and cool outputs. In the water unit, this alarm is not critical and will automatically reset the controller once the pressure signal is regained.

In water units with manual fill reservoir tanks, the pressure switch input can be bypassed during initial start-up with an adjustable timer located in the Secure menu. This time period should be kept as short as possible to prevent damage to the pump seal.

In oil units, during the Auto Mode, the loss of the pressure switch disables the heater output and the pump motor output will remain on for a preset time period (Pressure Timer = OFF, 2sec, 5sec, 30sec, or 1 to 10 minutes).

Use the following procedure to change the Pressure Timer for oil TCUs:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Pressure Timer.”
4. Press the Enter button.
5. Use the Up and Down buttons to adjust the value of the timer.
6. Press the Enter button to accept the change.
7. Press the Alarm Silence button to return to Running mode.

### ***Low Fluid Level Alarm***

This factory-set alarm occurs when the low level switch is in a closed condition. This is not a critical alarm and will reset once the condition is cleared. For water TCUs the Low Level alarm disables the heater and the pump motor outputs. For oil TCUs it disables the heater output. There are no menus that affect this alarm.

### ***High Fluid Level Alarm***

This factory-set alarm occurs when the high level switch is in a closed condition. This alarm is only applicable for water TCUs. This is not a critical alarm and will reset once the condition is cleared. It is an alarm only and no outputs are disabled.

### ***Pump Failure Alarm***

This critical, factory-set alarm occurs when one of three conditions occurs: phase loss, phase reversal, or motor overload trip. If any of these occur, the heat, cool, and pump motor outputs are disabled. Turn the unit off and then on again to reset the fault.

### ***Safety Thermostat Alarm***

This critical, factory-set alarm occurs when the thermostat sensor opens on a high temperature condition. For both water and oil TCUs, the heater output is disabled, but the pump and cooling outputs are still active. For water TCUs, the cooling output will latch on. Turn the unit off and then on again to reset the fault.

### ***Welded Contactor Alarm***

This critical factory-set alarm occurs when the controller senses that an auxiliary contact has remained closed after a preset time period after the heater output has been turned off. The heater output is disabled, and the cool and pump motor outputs are enabled to prevent temperature runaway. This alarm is an option for water TCUs and is standard for oil units. Turn the unit off and then on again to reset the fault.

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### ***5-5 Using the Second Setpoint Function***

With this function, the user can send the controller a dry contact closed signal to activate the second setpoint. Opening the dry contact causes the controller to revert to the primary setpoint. To reinitiate the second setpoint, the switch must be closed again.

Use the following procedure to enable the second setpoint function:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads "SP2/RmtStart."
4. Press the Enter button.
5. Use the Up and Down buttons to change the value to "SP2."
6. Press the Enter button to accept the change.
7. Press the Alarm Silence button to return to Running mode.
8. Press the Index button to access the Primary menu.
9. Press the Enter button.
10. Press the Index button until the display reads "Aux Set Point."
11. Press the Enter button.
12. Use the Up and Down buttons to change the value. The range is between the SetPtLoLimit and the SetPtHiLimit in the Secure menu.
13. Press the Enter button to accept the change.
14. Press the Alarm Silence button to return to Running mode.

### ***5-6 Using the Remote Start Function***

With this function, the user can send the controller a dry contact closed signal to activate the controller. Stopping the unit can be done one of two ways: removing the signal or pressing the Stop button on the face of the controller. Either method will initiate the Automatic Shutdown routine within the controller. The remote contact must be opened to reset the controller.

### ***5-7 Changing the Temperature Display Units***

The controller is set up to display the temperature, and all related temperature settings, in either degrees Fahrenheit or degrees Celsius. Use the following procedure to change the display units:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button one time to access the “Degrees (F/C)” parameter.
4. Use the Up and Down buttons to change the value.
5. Press the Enter button to accept the change.
6. Press the Alarm Silence button to return to Running mode.

### ***5-8 Setting the Temperature Display Precision***

The controller is factory-set to display the temperature, and all related settings, as an integer. The user has the ability to change the display precision to tenths of a degree. Use the following procedure to change the display precision:

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Precision.”
4. Use the Up and Down buttons to change the value.
5. Press the Enter button to accept the change.
6. Press the Alarm Silence button to return to Running mode.

## ***5-9 Using the Elapsed Time Meter***

The controller is equipped with an elapsed time meter that keeps track of the time that the pump motor has run in hours. The meter is enabled or reset in the Secure menu and viewed in the Primary menu.

Use the following procedure to enable the elapsed time meter:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads "ElapsedTimeMode."
4. Use the Up and Down buttons to change the value to "ON."
5. Press the Enter button to accept the value.
6. Press the Alarm Silence button to return to Running mode.

Use the following procedure to view the elapsed time meter:

1. Press the Index button one time to access the Primary menu.
2. Press the Enter button.
3. Press the Index button until the display reads "ElapsedTime."
4. Press the Alarm Silence button to return to Running mode.

Use the following procedure to reset the elapsed time meter:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads "ElapsedTimeMode."
4. Use the Up and Down buttons to change the value to "RST."
5. Press the Enter button to accept the value.
6. Press the Alarm Silence button to return to Running mode. At this point the meter has been reset to zero hours.

## 5-10 Programming Ramp/Soak

The controller has a 16-segment, front-face programmable Ramp/Soak feature. Unused alarms can be programmed as a segment.

### ⚠ CAUTION

***Do not attempt to auto-tune the controller during a ramp/soak program. The Tune button will not function during this process.***

Instead of requiring the operator to calculate an approach rate, the controller does the calculation automatically. The operator needs to program the target setpoint and the time desired to reach that setpoint. When the controller executes the ramp segment, it calculates the ramp required to reach the process temperature from starting setpoint to the programmed setpoint in the time allowed. (See Figure 2 for sample ramp/soak program.)

Dwells (or soaks) are ramp segments with target setpoint equal to starting process temperature. This allows for multistage ramps without wasting intermediate soak steps.

### NOTICE

***Before programming Ramp/Soak, evaluate your program on paper. Test any program for best results before running production material.***

### ⚠ CAUTION

***Make sure to run auto-tune before operating Ramp/soak because Ramp functions will interfere with the operation of the auto-tune***

Segment Prompt	Function	Time (min.)	Setpoint, °F
1TI	1st Event	1	
1SP			50
2TI	2nd Event	2	
2SP			150
3TI	3rd Event	2	
3SP			150
4TI	4th Event	2	
4SP			100
5TI	5th Event	1	
5SP			100
6TI	6th Event	2	
6SP			50
7TI	Un-Used	0	
7SP	Hold Last Setpoint		50
↓	Un-Used		
GTI	Un-Used	0	
GSP			50
END	Stay at present setpoint (GSP)		HOLD
END	Revert to SP1 value		SETP
END	Repeat program at 1TI		LOOP

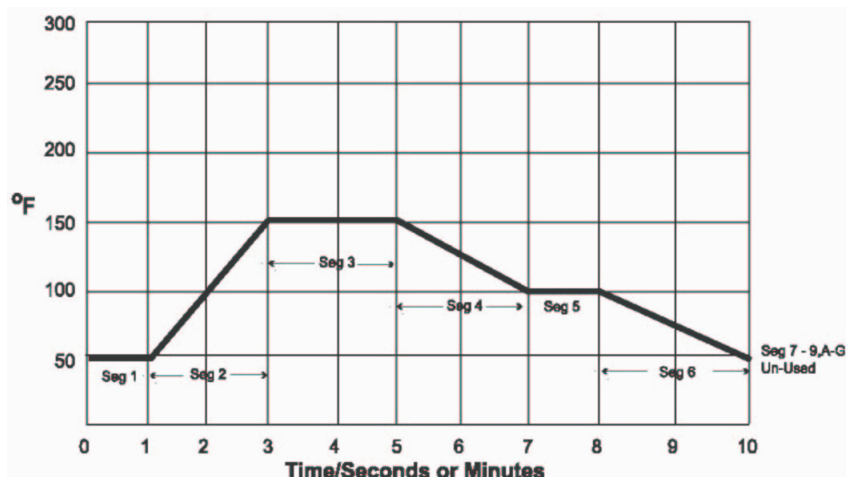


Figure 2: Sample Ramp Soak Program

Use the following procedure to program the Ramp/Soak functions:

**Starting Ramp/Soak Programming:**

1. Press the Index button two times to access the Secondary menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Prog Ramp/Soak.”
4. Use the Up and Down buttons to change the parameter to “On.”
5. Press the Enter button to accept the change.
6. Press the Index button one time to access the “Prog Values” parameter.
7. Press the Enter button.
8. Use the Up and Down buttons to change the parameter to “On.”
9. Press the Enter button to accept the change.
10. Press the Index button until the display reads “Prog Time Base.”
11. Press the Enter button.
12. Use the Up and Down buttons to change the time base for each segment. Choose seconds or minutes. (1s=seconds, 60s=minutes.)
13. Press the Enter button to accept the change.

**Programming the Ramp/Soak Segments:**

1. Press the Index button one time to access the “Seg 1 Time” parameter.
2. Press the Enter button.
3. Use the Up and Down buttons to change the length of time for Segment 1.
4. Press the Enter button to save the segment time for Segment 1.
5. Press the Index button one time to access the “Seg 1 SetPoint” parameter.
6. Press the Enter button.
7. Use the Up and Down arrows to set the desired setpoint at the end of Segment 1.
8. Press the Enter button to save the setpoint for Segment 1.
9. Repeat steps 1-8 for each of the 16 segments. Segment time should be set to 0 for unused segments.

**Finishing the Ramp/Soak Programming:**

1. Press the Index button until the display reads “Prog End.”
2. Press the Enter button.
3. Use the Up and Down buttons to change the value for the desired reaction at the end of the program. “OFF” will power down the TCU after the program; “HOLD” will control the setpoint from the last segment after the program; “LOOP” will continuously loop through the program; “SETP” will control at the setpoint prior to the program.
4. Press the Enter button to accept the value.
5. Press the Alarm Silence button to return to Running mode.
6. Press the Run/Hold button to activate the program.



### ***Controlling Ramp/Soak***

The Secondary Menu parameter “Prog Ramp/Soak = “ must be set to ‘ON’ in order to control the ramp/soak operation.

Press the ‘RUN/HOLD’ button on the panel to put the ramp/soak operation into the Run state. The LCD display will change from “Running” to “RAMPSOAK”. The setpoint will step to the programmed value over the programmed time period and the process will be changed accordingly.

Press the ‘RUN/HOLD’ button again to toggle the ramp/soak operation into the Hold state. The LCD display will change from “RAMP/SOAK” to “R/S HOLD”. The setpoint will be held at its current value and the process will control at that value for as long as the Hold state continues.

Press the ‘RUN/HOLD’ button again to toggle the ramp/soak operation back into the ramp/soak Run state.

While the Ramp/Soak operation is running, there are two ways to abort the operation:

- Hold down the RUN/HOLD key for 3 seconds.
- In the Secondary Menu, set the “Prog Ramp/Soak = “ parameter to ‘OFF’.

### ***Monitoring Ramp/Soak***

If the “Status of Prog” parameter in the Secondary menu is set to “ON”, the Primary menu will display the following items:

- “PrgSeg# Remain = ###” displays the remaining time in the current segment.
- “PrgSeg# Time = ###” displays total time of the current segment.
- “PrgSeg# StPt = ###” displays the setpoint of the current segment.

If the “Status of Prog” parameter is set to “OFF”, the additional menu items will not appear in the Primary menu.

### ***5-11 Setting the Approach Rate***

The controller is provided with a selectable up and down ramp to setpoint feature, located in the secure menu. The time base is in minutes and is adjustable from off to 99 minutes in 1 minute increments.

Use the following procedure to enable the approach rate feature:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Approach Rate.”
4. Use the Up and Down buttons to select the time period in minutes.
5. Press the Enter button to accept the value.
6. Press the Alarm Silence button to return to Running mode.

### ***5-12 Level Input Operation (Water Units)***

All level inputs have a three-second input suppression timer to prevent false input signals caused by turbulent fluid. The level input has a menu selection for CONTROL or ALARM in the Secure menu.

When the machine is started, the controller will determine if a high- or low-level condition is present. If the water level is below the low-level mark, the fill solenoid is enabled, filling the tank. Once the water level is above the high-level mark, filling stops, and the pump, cooling, and heating outputs are enabled.

As the process fluid is circulated through the system, the fluid level may fall. The control system will continue to function without interruption. If a low-level condition exists for more than three seconds, the pump, cooling, and heating outputs are disabled while the fill solenoid re-fills the tank.

The controller has a Water Fill Timer, which can be set in the Secondary menu. The timer can be set to “OFF” or from 1 to 180 minutes. When it is set to off, there is no time limit for the fill solenoid. When it is set to on, and the low level does not clear in the preset time, the fill solenoid valve will turn off.

### ***5-13 Adjusting the LCD Display Contrast***

Potentiometer R82, on the controller main PC board, is used to adjust the contrast of the LCD. The range of adjustment varies from completely off, where nothing is displayed on the LCD, to fully on, where the display “blooms” and may not be readable. Adjust the potentiometer to achieve an acceptable viewing condition somewhere between the two extremes.

### ***5-14 Adjusting the Auto Shutdown Temperature Setpoint***

The controller is provided with an adjustable shutdown setpoint. The range is 90°F to 180°F (32°C to 82°C). Use the following procedure to change the shutdown temperature:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button
3. Press the Index button until the display reads shut down temp.
4. Press the Up or Down buttons to select the new temperature.
5. Press the Enter button to accept the value
6. Press the Alarm silence button to return to the Running mode.

## 5-15 Calibrating the T/C, RTD, and V Inputs

### NOTICE

*ACS Group will certify that all controllers are factory calibrated and the calibration parameters are electronically stored in the controller to maintain its optimum performance. Due to the design of our input circuitry, the factory calibration should be valid for the life of the instrument. ACS Group controllers are not calibrated to a traceable N.I.S.T. standard.*

*ACS Group can provide documentation to support that our 1000-ohm RTD's are currently manufactured to IEC 751 specifications. All product testing is performed in accordance with established procedures, using standards traceable to the National Institute of Standards and Technology.*

This calibration procedure describes the operator procedures for calibrating the Controller Sensor Input (T/C and RTD) and the Analog input (V).

Use the following procedure to calibrate all three sensor inputs:

1. While the controller is powering on, hold the Index button and the Enter button when the “Selftest in Progress” message is displayed. This will put the controller into Factory mode.
2. Press the Index button two times so that the display reads “Calibrate?<ENT=YES>”.
3. Press the Enter button to begin calibration.
4. Use the Index button to cycle through the six calibration parameter menu selections:
  - LOCalJTC(25C) = nn.n
  - HICalJTC(345C) = nn.n
  - LOCalR1K(10R) = nn.n
  - HICalR1K(2K1) = nn.n
  - LOCalRSp(0.1V) = nn.n
  - HICalRSp(9.9V) = nn.n
5. Use the Up and Down buttons to select the calibration value for each parameter.
6. Press the Enter button to save the value.

### Calibrating the Thermocouple Input (T/C)

### NOTICE

*This thermocouple calibration procedure requires a “J” T/C reference source to calibrate this analog input circuit. Once the circuit is calibrated, either a Type “J” or a Type “K” thermocouple can be selected for operation.*

1. Put a jumper on pins 2 and 3 of JMP2 on the main PC board to select the T/C input type.
2. Connect the “J” thermocouple calibration source to pins 3 (+) and 4 (-) on the J5 connector on the main PC board.
3. Select the “LOCalJTC(25C)” parameter.
4. Set the “J” thermocouple low calibration source to 25°C. Use the Up and Down buttons to change the value on the display to 25.0.
5. Press the Enter button to save the value.
6. Select the “HICalJTC(345C)” parameter.
7. Set the “J” thermocouple high calibration source to 345°C. Use the Up and Down buttons to change the value on the display to 345.0.
8. Press the Enter button to save the value.
9. Cycle between the Low and High parameters and readjust the values if needed to compensate for any interaction that may occur between the two parameter

## Calibrating the RTD Input

### NOTICE

*This RTD calibration procedure requires a 0 to 1000 ohm Decade Resistance box to calibrate this analog input circuit. Once the circuit is calibrated, either a 100 ohm RTD or a 1000 ohm RTD can be selected for operation.*

1. Put a jumper on pins 1 and 2 of JMP1 on the main PC board to select the RTD input type.
2. Connect the Decade Resistance Box to pins 1 and 2 on the J5 connector on the main PC board.
3. Select the “LOCalJR1k(10R)” parameter.
4. Set the decade resistance box low calibration value to 10 Ohm. Use the Up and Down buttons to change the value on the display to 10.0.
5. Press the Enter button to save the value.
6. Select the “HICalR1K(2K1)” parameter.
7. Set the decade resistance box high calibration value to 2100 Ohm. Use the Up and Down buttons to change the value on the display to 2100.0.
8. Press the Enter button to save the value.
9. Cycle between the Low and High parameters and readjust the values if needed to compensate for any interaction that may occur between the two parameters.

## Calibrating the Analog Input (V)

### NOTICE

*This analog input calibration procedure uses a Voltage source for this analog input circuit. Once the circuit is calibrated, the JMP4 jumper can be changed for a Milliamp or Voltage input source for operation.*

1. Put a jumper on pins 2 and 3 of JMP4 on the main PC board to select a Voltage input source.
2. Connect the voltage calibration source to pins 7 (+) and 8 (-) on the J5 connector on the main PC board.
3. Select the “LOCalRSp(0.1V)” parameter.
4. Set the voltage low calibration source to 0.1V. Use the Up and Down buttons to change the value on the display to 0.100.
5. Press the Enter button to save the value.
6. Select the “HICalRSp(9.9)” parameter.
7. Set the voltage high calibration source to 9.9V. Use the Up and Down buttons to change the value on the display to 9.900.
8. Press the Enter button to save the value.
9. Cycle between the Low and High parameters and readjust the values if needed to compensate for any interaction that may occur between the two parameters.

## ***5-16 Accessing the Debug Menu***

The controller has a troubleshooting tool in the secure menu. Use this menu to assist in debugging communications errors and flow sensor input errors.

Use the following procedure to troubleshoot communications errors:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Debug”.
4. Press the Enter button.
5. Press the Up button until the top display reads “Comm. Activity [TX and RX]” and the bottom display reads “Debug 1.”
6. Press the Enter button.
7. Press the Alarm Silence button to return to Running mode. The top line of the LCD display will indicate by flashing “TX” and “RX”, the transfer of commands between the host and the slave controllers. If one of the characters isn’t flashing, it is not communicating.
8. Return to the Debug program and turn it off after the troubleshooting task is complete.

Use the following procedure to troubleshoot flow sensor input errors:

1. Press the Index button three times to access the Secure menu.
2. Press the Enter button.
3. Press the Index button until the display reads “Debug”.
4. Press the Enter button.
5. Press the Up button until the top display reads “Flow Freq # # # HZ” and the bottom display reads “Debug 2.”
6. Press the Enter button.
7. Press the Alarm Silence button to return to Running mode. The top line of the display will read “Flow Freq” with a value in Hertz. Use this value to verify calibration or verify the presence of an input signal.
8. Return to the Debug program and turn it off after the troubleshooting task is complete.

### 5-17 Reloading Factory Defaults

When factory default settings are reloaded, all special configurations (i.e., 4-20 ma scaling) will be lost. Please record menu variables before restoring the factory defaults.

Restoring factory defaults for low-heat water TCUs can be accomplished by entering “Factory mode.” Use the following procedure to restore factory defaults:

#### NOTICE

***TCUs will default to a 250°F (121.1°C) set-stop limit. For 550°F (287.7°C) applications, the controller must be reset for a high-heat configuration (see below).***

1. Cycle control power to system Off and On.
2. While the controller is performing the self test, simultaneously press the Index and Enter button together to enter Factory mode.
3. Press the Index button until the display reads “Default<ENT=YES>.”
4. Press the Enter button to accept the factory defaults. Both displays will flash the words “OFF” and “ON” indicating reboot is complete.
5. Restart the controller to automatically return to Running mode.

TCUs will default to a 250°F (121.1°C) set-stop limit.

For 550°F (287.7°C) applications, the controller must be reset for a high-heat configuration. Use the following procedure to configure the TCU for high-heat applications:

1. Press the Index button until the “Secure Menu” prompt is in the display.
2. Press the Enter button.
3. Security level “SEC = 4” should be displayed. If not, use the Up arrow to scroll to “111.” Press the Enter button.
4. Press the Index button to display “Unit Function = HEATLO.”
5. Use the Up/Down arrows to change the display to “Unit Function = HEATHI.”
6. Press the Enter button and the Down button simultaneously to accept the factory default settings. The LCD will flash off and then on to indicate that the default settings have been restored. The controller will automatically reboot and turn off the controller.
7. Press the Start button to enable the TCU.

## 5-18 Serial Communications Operation

The controller communicates with a host machine via an RS232 or RS485 communication link when the communication option card is installed in the J8 slot on the motherboard. There are two versions of this option card; one is populated with the ICs to support RS232, and the other is populated with the ICs to support RS485. All data is sent and received in the bit data format, using 10 bits: 1 start bit, 8 data bits, no parity bits, and 1 stop bit. This communications options card uses the J12 connector.

The software supports two protocols, SPI and MODBUS, which are user selectable in the menus. All communication parameters can be accessed through the setup menus only when a communication option card is installed:

Primary Menu: “Comm Addr(Hex)=xxxx” specifies the operating address in hex from 0001H to 03E7H. (This parameter is duplicated in Menu 3.)

Secure Menu: “Comm Protocol = xxx” select either SPI or MODBUS.

Secure Menu: “Comm Addr(Hex)=xxxx” specifies the operating address in hex from 0001H to 03E7H.

Secure Menu: “Comm Baud Rate=xxxx” select 300, 1200, 2400, 4800, 9600, or 19.2KB.

**Secondary Menu:** “Comm Local/RMT” [RMT enables serial communication]

### Port Address

Operator selection of the address to use is from a menu parameter selection of 1H to 3E7H.

#### NOTICE

***For MODBUS configuration, this address setting must be set between 1 and 247 (0x00Hex to 0xF7Hex).***

The default value for this parameter is 1H. The SPI DEVID specified in the SPI Protocol Specification field is set by this PORT address setting.

#### NOTICE

***For SPI configuration, the address setting must be set between 32 and 255 (x20Hex to 0xFFHex).***

### Baud Rate and Data Format

Operator selection of the baud rate to use is from a menu parameter selection of 300, 1200, 2400, 4800, 9600, or 19.2KB. The default value for this parameter is 9600 Baud. The data format is 1 start bit, 8 data bits, no parity, and 1 stop bit for all protocols.

### Protocols

Onboard protocols are Modicon Modbus RTU and SPI. SPI is only available in RS485. These follow the standard rules for these protocols. All other desired protocols will require an external gateway to be supplied by the manufacturer. Operator selection of the protocol to uses is from a menu parameter selection. The default protocol is MODBUS.

#### NOTICE

***When the protocol is changed, the port address must be set correctly in the range appropriate for the protocol.***



### **MODBUS Protocol**

Every message sent from a MODBUS master to a slave on to the network contains a function code that represents the action the slave device should take in response to the message. So that a MODBUS master can read and write the controller parameters, setpoints, and status values in an Athena Temperature controller, the Athena implementation of the MODBUS protocol supports the following function codes:

**function 03 (\$03)** This function is used to read to one or more contiguous “holding registers” (database locations that are next to one another in the register map).

**function 06 (\$06)** This function is used to write to a single holding register. A message containing function 06 can be broadcast to all controllers on the network simultaneously by sending the message to the controller ID of 0 (zero), instead of to the controller ID of a specific device.

**function 16 (\$10)** This function is used to write to a single register or to multiple contiguous holding registers, that is, to two or more registers that are next to one another in the register map. A message containing function 16 (\$10) can be broadcast to all controllers on the network simultaneously by sending the message to the controller ID of 0 (zero), instead of to the controller ID of a specific device.

So that you can test communication over the MODBUS network, Athena also supports the diagnostic **function 08 (\$08), subfunction 00 (\$00)** to perform a loopback test. When a loopback test is performed, the MODBUS master sends a message to a controller and the controller sends the same message back to the master. (No changes are made to the controller database as a result of processing the command.) If the master does not receive a reply, it is time to troubleshoot the network or the controller’s communication setup.

The controllers will not take any action, nor will they reply in response to any messages they cannot interpret. This includes any messages that contain a function code other than 03, 06, 16 (\$10), or 08 subfunction 00.

**Modbus Register Addressing Regions.** The regions (ranges) of register relative addresses used for the various types of representations of controller values are shown in the table below. Each register type used to transmit controller values was described in more detail earlier in this section (see the cross-references in the table).

**Figure 3: Modbus Address Regions**

Register Address Range	Region	Type of Value Used by the Controller	How Data is Transmitted in the Register
0000 to 0999	Integer	Integer	16-bit Integer
1000 to 1999	10X mirror of 0000 to 0999 base region	Can include fractional values	16-bit Integer
4000 to 4999	32-bit IEEE mirror of 0000 to 0999 base region	Can include fractional values	32-bit IEEE floating point
All others	Reserved	Reserved	Reserved

#### **NOTICE**

*The Register Address field in the Message protocol should be offset (-1), from the point number shown in Table 13*

**Modbus Accessible Parameter Mapping.** The customized controller allows access to (29) controller parameters and settings, which can be accessed in Integer Mode or Floating point mode. This is accomplished with (2) Point Address ranges, allowing data exchange in either integer or floating point format, for all controller parameters and settings. All data conversion such as rounding, integer float, Etc, is transparent and handled by the controllers, since internal variables data type can be different for the MODBUS data exchange types.

The Advanced and M2B+ controllers are customized controller software supports the following Modbus Parameters and Settings:

**Figure 4: Modbus Parameters List**

Parameter / Item Index	R/W	Integer Data Region Point Address	Float Data Region Point Address	Min Value	Max Value	Description
0	R	0000	4000	0	0	Version ID (4369)
1	R	0001	4002	-34	343	Delivery Temp (°C)
2	R	0002	4004	-34	343	Mold Temp (°C)
3	R	0003	4006	-34	343	Return Temp (°C)
4	R	0004	4008	0	999	Flow Value
5	R/W	0005	4010	0	1	System Standby Heat/cool
6	R/W	0006	4012	0	1	Temp Units
7	R/W	0007	4014	-34	343	Setpoint 1 (°C)
8	R/W	0008	4016	-34	343	Setpoint 2 (°C)
9	R/W	0009	4018	-34	343	Alarm 1 Low (°C)
10	R/W	0010	4020	-34	343	Alarm 1 High (°C)
11	R/W	0011	4022	1	343	Prop. Band Heat (°C)
12	R/W	0012	4024	1	343	Prop. Band Cool (°C)
13	R/W	0013	4026	0	999	Reset (seconds)
14	R/W	0014	4028	0	999	Rate (seconds)
15	R/W	0015	4030	0	999	Autotune.State
16	R/W	0016	4032	0	999	Autotune.TuneDutyPercent
17	R/W	0017	4034	0	999	Autotune.PeakOverShoot
18	R/W	0018	4036	0	999	Autotune.PeakUnderShoot
19	R/W	0019	4038	0	999	Autotune.InitialTempDeviation
20	R/W	0020	4040	0	999	Autotune.ProcessTripTemp
21	R	0021	4042	-34	343	Delivery Temp (°F)
22	R/W	0022	4044	-34	343	Setpoint 1 (°F)
23	R/W	0023	4046	0	999	Proportional Percent (%)
24	R/W	0024	4048	0	999	Integral Percent (%)
25	R/W	0025	4050	0	999	Direvative Percent (%)
26	R/W	0026	4052	0	999	PID Output Percent (%)
27	R/W	0027	4054	0	999	Heater Output Percent (%)
28	R/W	0028	4056	0	999	Cooling Output Percent (%)
30	R	0030	4060	0	1	Pump Status
31	R	0031	4062	0	1,2,3	Heater Status; 1=low, 2=high, 3=low & high
32	R	0032	4064	0	1	Vent Status

**MODBUS Function 03 Request.** The format for a function 03 request is shown below.

Device Address	Function Code 03	Register Address		Number Of Words To Read		CRC	
1 byte	1 byte containing \$03	MSB	LSB	MSB	LSB	MSB	LSB

**MODBUS Function 03 Request Example.** Suppose you want to Read Delivery Temperature in Float 32 Bit IEEE Format, which has registers address of "4002" and if the controller ID is "01".

Device Address	Function Code 03	Register Address		Number Of Words To Read		CRC	
\$01	\$03	\$0F	\$A2	\$00	\$02	\$66	\$FD

**Function 03 Normal Reply.** The controller reply will consist of the following data:

01= MODBUS unit ID

03= MODBUS command: read holding registers

0F = high byte of first register to read

A2 = low byte of first register to read

0FA2 = 4002 decimal

00 = high byte of number registers to read

02 = low byte of number of registers to read

2 = 16-bit registers are read in a single command, to get all of a 32-bit floating point register

66 = low byte of CRC of command packet

FD = high byte of CRC of command packet

Following is an example of normal reply response showing Process Temperature = 37.6° C

Device Address	Function Code 03	Number Bytes of Data	IEEE32 BitFloat Data Field See Modbus Spec.				CRC	
\$01	\$03	\$04	\$C0	\$93	\$42	\$16	\$87	\$70

## ***SPI Protocol***

The Society of the Plastics Industry (SPI) communication protocol specifies a connection management Protocol, a packetized communication format, and communication error mechanisms passing commands and data between a host computer and a slave. A host computer initiates all communications. The protocol used corresponds to the 3.01 version of the SPI communication protocol specification dated October 1990. The data is transmitted via a multi-drop EIA485 (half-duplex) hookup. The controller will support a number of commands that will allow the host computer to retrieve status and assign setpoints. The commands correspond to a mold temperature controller device.

### **Commands Descriptions**

- |       |   |
|-------|---|
| (20H) | Echo poll-Controller integrity command. Return the 4 bytes of ASCII assigned by the Echo Select command in an open format.  |
| (21H) | Echo Select -Controller integrity command. Supplies 4 bytes of ASCII in an open format that is to be returned when an Echo Poll command is received.  |
| (22H) | Version poll-Returns a version number (MBB =0101) as 4 bytes of ASCII in an open format where: AA = SPI assigned version level, BB = Vendor assigned version level  |
| (30H) | Setpoint poll - Returns the current process setpoint value in numeric format.   |
| (31H) | Setpoint select -Assigns a value to the process setpoint in numeric format.   |
| (32H) | Alarm, high temperature deviation poll -Return the high temperature deviation setpoint value in numeric format. This value when added to the process setpoint gives the temperature at which a high alarm will occur.   |
| (33H) | Alarm, high temperature deviation select -Assigns a value to the high temperature deviation setpoint in numeric format.   |
| (34H) | Alarm, low temperature deviation poll -Returns the low temperature deviation setpoint value in numeric format. This value when subtracted from the process setpoint gives the temperature at which a low alarm will occur.  |
| (40H) | Status process poll -Returns the status of the process as 16 flag bits in open format. The following bits are supported. The rest are set to 0.<br><div style="margin-left: 40px;">Bit 0 - Processing<br/>Bit 1 -Alarm, System<br/>Bit 2 -Alarm, Process<br/>Bit 3 -Alarm, Machine<br/>Bit 4 -Alarm, High Temperature<br/>Bit 5 -Alarm, Low Temperature<br/>Bit 7 -Alarm, Low Pressure<br/>Bit 9- Alarm, Low Flow</div> |
| (42H) | Status, machine 1 poll - Returns the status of the machine as 16 flag bits in open format. The following bits are supported. The rest are set to 0.<br><div style="margin-left: 40px;">Bit 0 - Processing<br/>Bit 1 -Alarm, System<br/>Bit 2 -Alarm, Process<br/>Bit 3 -Alarm, Machine<br/>Bit 4 -Alarm, High Temperature</div>   |

- Bit 5 -Alarm, Low Temperature
- Bit 7 -Alarm, Low Pressure
- Bit 14 -Alarm, Phase Reversed or Lost
- (44H) Status, machine 2 poll-Returns the status of the machine as 16 flag bits in open format. The following bits are supported. The rest are set to 0.
  - Bit 0 -Processing
  - Bit 1 -Alarm, System
  - Bit 2 -Alarm, Process
  - Bit 3 -Alarm, Machine
  - Bit 4 -Fault, Sensor, Delivery
  - Bit 5 -Fault, Sensor, Return
- (48H) Mode, Machine Poll-Returns the current status of temperature control unit if the machine is On (1) or Off{O}.
- (49H) Mode, Machine Select-Commands the temperature control unit to turn On(1) or Off(D)
  - Bit 0- Machine On/Off, Bit 1 -Alarm Acknowledge
- (70H) Temperature, to process poll-Returns the delivery temperature in numeric format.
- (72H) Temperature, from process poll -Returns the return temperature in numeric format.



# Chapter 6: Troubleshooting

This Troubleshooting section should be used in conjunction with the Troubleshooting section of the unit that the controller was supplied with. The problems listed below are displayed on the LCD and the action the user takes will depend on whether the alarm is critical or non-critical.

Problem	Possible Cause	Solution
Process Temperature Alarm does not acknowledge when Process Temperature is lower than Setpoint	Alarm configuration is set up incorrectly.	Change the configuration to Low, High, High/Low, or Event. See 5-4 on page 34.
	Alarm Mode is configured incorrectly	Change the Mode to either Absolute or Deviation. See 5-4 on page 34.
	Alarm trip point incorrect set.	Change the value of the high or low tripping point for the alarm. See 5-4 on page 34.
Process Temperature Alarm does not acknowledge when Process Temperature is higher than Setpoint	Alarm configuration is set up incorrectly.	Change the configuration to Low, High, High/Low, or Event. See 5-4 on page 34.
	Alarm Mode is configured incorrectly	Change the Mode to either Absolute or Deviation. See 5-4 on page 34.
	Alarm trip point incorrect set.	Change the value of the high or low tripping point for the alarm. See 5-4 on page 34.
Setpoint will not change with a change of Remote Analog Setpoint value, or setpoint displays 0.	Remote input is not enabled.	Change the value for "Remote Input" in the Secondary Menu to SETP.
	Remote input is incorrectly configured.	
	Remote Signal value is incorrect.	Change the range for "Remote Signal" to desired setting.
Ramp/Soak program does not transition to desired setpoint.	The status of the program has been stopped.	Either Press the Run/Hold button on the face of the controller or change the value of "Prog Ramp/Soak" in the Secondary Menu to ON.
	The segment setpoint is incorrect.	Change the value of "Seg # SetPoint" to desired temperature.
	The program time is too short for the heating/cooling capacity of the unit.	Change the value of "Seg # Time" to a longer timer period.
Last setpoint in Ramp/Soak program reverts back to first setpoint	The Program End function is incorrectly configured.	Change the value of "Prog End" to HOLD.
Ramp/Soak program never stops cycling through steps	The Program End function is incorrectly configured.	Change the value of "Prog End" from LOOP to desired action at the end of program.

Problem	Possible Cause	Solution
Unit shuts down after running through Ramp/Soak program	The Program End function is incorrectly configured.	Change the value of “Prog End” from OFF to desired action at the end of the program.
Setpoint temperature does not change when using the Up or Down Arrow keys	Security password set to lockout status	Change security setting to gain access to parameters.
	Controller setup in remote analog input.	Change “Remote Input” parameter in Secondary Menu to “OFF.”
Buttons on the face of the controller do not function when pressed	Security password set to lockout status	Change security setting to gain access to parameters.
	Controller parameters setup to in remote function.	Change parameters to be in local function.
	Excessive environment noise	Consult factory.
Controller does communicate with remote host computer	Communications board improperly installed.	Check slot J8 on the secondary controller board to ensure proper board installation
	Incorrect protocol selected	Change parameter “Comm Protocol” in the Secure Menu to proper protocol (MOD for MODBUS® RTU or SPI)
	Incorrect address selected	Change the parameter “Comm Addr (Hex)” in the Secure Menu to a unique address in hexadecimal. This parameter will depend on the type of protocol being used. (See debug menu on page.)
	Incorrect communications speed.	The parameter “Comm Baud Rate” in the Secure menu must equal the speed of the host computer to communicate properly.
No Flow display	Check flow amp. JMR 5’ Lo for low signal level <IVPP Hi for high signal level >IVPP	Change jumper location
	Check for pull up or pull down resistor on sensor input	Replace IK Resistor per elementary diagram. (See debug menu.)
LCD Display is dark	Contrast needs to be adjusted	Adjust POT, R82 to left or right until display illuminates.
Backlight is on, display reads “Power Available” [System off], Setpoint and process display has all 8’s.	“J6” DC input connector isn’t inserted into socket or all DC inputs are open at the same time	Insert 12 pin plug into the “J6” socket and recycle power to the controller.
Sensor Low Display	Process temperature is outside of the sensor ref. Table range.	Consult factory.



## 6-1 Operating Mode and Error Display Messages

**Figure 5: Display Messages, Operational and Errors**

Message Type	Display Presentation	Description
Normal Autotune	Autotuning [   ]	
Normal Running	Running [   ]	Running. (High Heat and Cool shown is Normal)
Normal RampSoak	Rampsoak [   ]	
Alarm	Alarm1/2 [LoFluid LVL]	This Indicates Alarm Low Fluid Level
Alarm	Alarm1/2 [Lo Pressure]	This Indicates Alarm Low Pressure
Alarm	Alarm1/2 [High LEVEL]	This Indicates Alarm High Fluid Level
Alarm	Alarm1/2 [Process]	This Indicates Alarm Temperature Process Exceeded
Alarm	Alarm1/2 [Deviation]	This Indicates Alarm Temperature Deviation Exceeded
Alarm (Major Fault)	Alarm1/2 [SafetyTherm]	This Indicates Alarm Safety Thermostat Alarm Input Detected
Alarm [Major Fault]	Alarm1/2 [SensorRange]	This Indicates Sensor Over-range or beyond range of the unit.
Alarm [Major Fault]	Alarm1/2 [Sensor Open]	This Indicates Delivery, Return or Remote Sensor Open or Not Connected to the input connector
Alarm (Major Fault)	Alarm1/2 [WeldContact]	This Indicates Heater Weld Contact Input Detected
Alarm (Major Fault)	Alarm1/2 [Pump Fail]	This Indicates Pump Phase Error Input Detected
Alarm	Alarm1/2 [Event]	This Indicates Ramp Soak Segment Event Alarm
Alarm	Alarm1/2 [Lo Flow]	This Indicates Flow Sensor Alarm Low Flow
Alarm	Alarm1/2 [Hi Flow]	This Indicates Flow Sensor Alarm High Flow
Tank Fill	Running [TankFill]	Automatic Tank Fill Mode Active
	Prom/Signature Error Alternating with Loading Factory defaults	RS Comm Card Installed in DAC Card Slot
	Temp= -44° F	Sensor set to RTD in Secure Menu, JMR 1 or 2 set for T/C Input

# Chapter 7: Appendix

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## 7-1 *Electrical Specifications*

### ***General***

Dimensions	5.5" X 9" X 4" (140 x 230 x 100)
Range of the Unit	-45°F to 650°F (-42.7°C to 343°C)

### ***Normal Operating Environment***

Operating Temperature Range	0° C to 40° C (LCD Display up-to 50° C) (-32°F to 104°F, display up to 122°F)
Humidity	0 to 95% RH (Non condensing)

### ***Storage Environment***

Storage Temperature Range	-10° C to 95° C (50°C to 203°F)
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### ***Primary, Power Supply (Line Power)***

Typical Supply Voltages	120VAC, 60Hz
Operating Range	85 to 150Vac 50/60 Hz, Single Phase
Consumption (Max/Typical)	15 Max/ 12 Watts Typ.
Connector Type/Model	5.8 mm Terminal Connector

### ***Alarm Outputs***

Mechanical relay Type (2 Outputs)	1A @120VAC INDUCTIVE (Alarm 1 tied to incoming AC, Alarm 2 contacts only/no applied power).
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### ***External System Outputs***

SCR/Triac Type	120Vac, 1A continuously @ 60° C for all output loads. Snubbers to be applied externally by customer; there will be no board mounted snubbers
System Output Variables	Pump, Vent, Heater High/Low Cool, Aux (Purge), Alarm 1, Alarm 2

### ***User Interface***

Keyboard	Membrane Type, with Snap Dome Contacts
LCD Backlight	LCD Brightness fixed/preset with Adjustable Pot. Backlight will automatically turn off when there is 5 minutes of inactivity on the Keyboard
Display	LCD Alphanumeric Display with Backlight

### ***Temperature Sensor Inputs***

Thermocouple Type	J, K, and T ungrounded Thermocouple Types (Class 2)
RTD Type	100Ω, 1000Ω RTD Type, 00385 COEF. 2 Wire (Class 2)
Measurement (Full Scale) Range	-40 °F to 650°F (-40°C to 343°C)
Process/Setpoint Display Resolution	1° C, 1° F, 0.1° C, 0.1° F
Measurement Accuracy	± 0.25% OF SPAN, ±LEAST SIGNIFICANT DIGIT
Number of Sensors Measured	Up-to, Three (3)
Common Mode Noise Rejection	100db MINIMUM AT 60 Hz.
Temperature Stability	4 uV/° C TYPICAL, 5 uV/° C MAX

### ***Flow Sensor Inputs***

Ranges	15-250Hz@80mV-1.6Vpp (sine) JMP5, pins 1-2 8-125Hz, 0-5Vdc pulsed JMP5, pins 2-3 (HI)
Resolution	15-250Hz@80mV-1.6Vpp (sine) JMP5, pins 1-2 8-125Hz, 0-5Vdc pulsed JMP5, pins 2-3 (HI)

### ***System Inputs***

Type	Dry Contact (0.5mA @ 5 Vdc Sense) CLASS 2
System Input Variables	Pressure / Low Level Phase Detection (2 Switches In Series) 2nd Setpoint / Remote Start Safety Thermostat Weld Contact Detect High Level
System / Dry Contact Input Ground	Common Grounding
Analog Input	0-10 V = 20K 4-20 mA = 50 OHM

### ***Optional Analog Output Modules***

Range	4-20mA @ 500 OHMS or 0-10Vdc, Jumper Selectable
Variables	Process Temperature, Setpoint Temperature, Heat, Cool
DAC Resolution	12 Bits
Agency Approval	cULus and File number Edward 318670, CE per EC Directive; 73/23/EEC, 93/68/EEC, Harmonized Standards; EN61010-1, 50081, 50082



## Menu Structure\*

Primary Menu	Secondary Menu	Secure Menu
System	Degrees (F/C)	Security Level
<i>Monitor Temp</i>	Precision	Unit Function
<i>Alarm 1 Low</i>	Alarm1 Cfg	Tune% Reduction
<i>Alarm 1 High</i>	<i>Alarm1 Mode</i>	Mold Offset
<i>PrgSeg#Remain</i>	<i>Alarm1 Reset</i>	Return Offset
<i>PrgSeg# Time</i>	<i>Alarm PwrIntr</i>	Delivery Offset
<i>PrgSeg# SetPt</i>	<i>Alarm1 PwrInhb</i>	Shutdown Temp
Tune Choice	Contact@Alarm1	Sensor Filter
DelivProp Band Heat	Alarm/Loop Break	Display Filter
DelivProp Band Cool	Prog Ramp/Soak	Setpoint Source
DelivReset Time	Prog Values	Link Terms
DelivRate Time	<i>Status of Prog</i>	Approach Rate
Cool Ratio	<i>Prog Time Base</i>	Sensor Monitor
<i>Mold Prop. Band</i>	<i>Seg # Time</i>	Flow Monitor
<i>Mold Reset Time</i>	<i>Seg # SetPoint</i>	<i>Flow Constant B</i>
<i>Mold Rate Time</i>	<i>Seg # A1 Event</i>	<i>Flow Constant K</i>
Aux Set Point	<i>Seg # A2 Event</i>	<i>Flow Filter</i>
<i>Flow Alarm Low</i>	<i>Prog End</i>	Safety Thermo
<i>Flow Alarm High</i>	<i>Alarm 2 Low</i>	PressLevel Inp
Auto Vent Cycle	<i>Alarm 2 High</i>	PressLevel
Crash Cool	<i>Alarm 2 DeadBnd</i>	<i>Pressure Timer</i>
High Heat	AntiRst Windup	SP2/RmtStart
ElapsedTime	PerCent Output	HighLevel Inp
<i>Comm Add(Hex)</i>	Loop Break Time	Weld Cont. Inp
	<i>Analog Output</i>	Sensor Type
	<i>Process OutLow</i>	MoldSensorType
	<i>Process OutHigh</i>	Input Fault Timer
	<i>Process Out Src</i>	Out1 Type
	<i>Heat Output</i>	Out2 Type
	Cool Output	SetPtLoLimit
	Remote Input	SetPtHiLimit
	<i>Remote Signal</i>	Output 1 Dir/REV
	<i>Remote SetPtLo</i>	Output 1 Low Limit
	<i>Remote SetPtHi</i>	Output 1 High Limit
	<i>Remote FlowSLo</i>	Absolute/Deviate
	<i>Remote FlowSHi</i>	Output 2 Dir/REV
	<i>Flow Display</i>	Output 2 Low Limit
	WaterFill Timer	Output 2 High Limit
	Peak PV	Alarm2 Cfg
	Valley PV	<i>Alarm2 Mode</i>
	<i>Comm. Local/Remote</i>	<i>Alarm2 Reset</i>
		<i>Alarm2 PwrIntr</i>
		<i>Alarm2 PwrInhb</i>
		Contact@Alarm2
		Alarm2LoopBrk
		ElapsedTimeMode
		<i>Comm Protocol</i>
		<i>Comm Addr(Hex)</i>
		<i>Comm Baud Rate</i>
		Debug

\*Menu items in **Italics** are only present when appropriate options or option boards have been installed.

Primary Menu Parameter Table						
LCD Text Message	Range	Units	Presets Water	Presets Oil	Presets Chiller	Parameter Description
System = nnn	OFF/ON	-	ON	ON	ON	‘ON’ = normal operation. ‘OFF’ = This will place the PID Control Loop on Standby and the heat and cool outputs will be turned off. Cannot change setpoint. LCD will display “System Standby”. PV temp is still monitored.
Monitor Temp = ###	###	-	0	0	0	Status parameter indicating the current Mold temperature.
Alarm 1 Low =nnnn	(SPL) to (SPH)	F/C	0	0	0	Alarm 1 Low Trip Point Setting. This setting applies in absolute and deviation alarm configuration modes.
Alarm 1 High =nnnn	(SPL) to (SPH)	F/C	200	200	200	(Default setting shown is when Alarm 1 Mode = ABSL). Alarm 1 High Trip Point Setting. This setting applies in absolute and deviation alarm configuration modes. (Default setting shown is when Alarm 1 Mode = ABSL).
PrgSeg#Remain = ###	# ###	-	0	0	0	Status parameter indicating the Ramp Soak Time Remaining Status. Shows in real time, the time remaining for the current active ramp/soak segment.
PrgSeg# Time = ###	# ###	-	0	0	0	Status parameter indicating the Ramp Soak Time Status. Shows the time setting for the current active ramp/soak segment.
PrgSeg# SetPt = ###	# ###	-	0	0	0	Status parameter indicating the Ramp Soak Setpoint Status. This shows the final setpoint target for the current active ramp/soak segment.
Tune Choice		-	PID	PID	PID	<b>Self</b> = Auto Tune <b>Slow</b> = Slow Reacting Process Preset PID <b>Normal</b> = Normal Reacting Process Preset PID <b>Fast</b> = Fast Reacting Process Preset PID
DelivProp Band Heat = nnn	2 to 650	-	13	10	12	PID Control Heat Proportional Band Setting.
DelivProp Band Cool = nnn	2 to 650	-	15	25	---	PID Control Cool Proportional Band Setting.
DelivReset Time = nnn	OFF, 1 to 999	Sec	24	40	90	PID Control Reset (Integral) Time
DelivRate Time = nnn	OFF, 1 to 999	Sec	6	8	100	PID Control Rate (Derivative) Time
Cool Ratio = nnn	OFF, 1 to 50	-	2	10	1	PID Control Cooling Ratio
Mold Prop. Band		-	36	36	0	Outer Loop PID Control Proportional Band
Mold Reset Time		-	OFF	OFF	0	Outer Loop PID Control Reset (Integral) Time
Mold Rate Time		-	OFF	OFF	0	Outer Loop PID Control Rate (Derivative) Time
Aux SetPoint = nnn	(SPL) to (SPH)	F/C	0	0	65	Sets the Auxiliary Set Point Value
Flow Alarm Low = nnn	OFF, 1 to 250 Gal / 946 Lit	-	1	1	1	Selects the Flow Alarm Low Trip Point Setting
Flow Alarm High= nnn	OFF, 1 to 250 Gal / 946 Lit	-	100	100	100	Selects the Flow Alarm High Trip Point Setting
Auto Vent Cycle= nnn	OFF, 1 to 10(Water), 1 to 60(Oil)	Min	1	1	OFF	Value causes an Auto Vent operation at power on
Crash Cool = nnn	OFF/ON	-	OFF	OFF	OFF	‘ON’ sets the Setpoint to 0 and turns on the COOL output
High Heat =nnnn	OFF/ON/AUTO	-	AUTO	ON	OFF	‘OFF’ = alternate Low A Heat and Low B Heat ‘ON’ = always High Heat
ElapsedTime=#####	#####	Hrs	0	0	0	‘AUTO’ = High Heat outside PB, alternate Low A / Low B inside PB
Comm Addr(Hex) =nnnn	0001 to 03E7	-	0001H	0001H	0001H	Status parameter indicating the total hours system is on Same as Comm Addr parameter in Secure Menu; SPI address starts at 20 Hex

## Secondary Menu Parameter Table

<i>LCD Text Message</i>	<i>Range</i>	<i>Units</i>	<i>Presets Water</i>	<i>Presets Oil</i>	<i>Presets Chiller</i>	<i>Parameter Description</i>
Degrees (F/C) = n	C/F	F/C	F	F	F	Thermal Units
Precision = nnnnnn	Integer/Decimal	-	Integer	Integer	Integer	Thermal Variable Precision. Integer or Decimal
Alarm1 Cfg =nnnn	OFF/LOW/HIGH/HILO/EVNT	-	OFF	OFF	OFF	Selects the Alarm 1 Configuration mode
Alarm1 Mode =nnnn	ABS/DEVI	-	DEVI	DEVI	DEVI	Selects Absolute or Deviation for Alarm 1
Alarm1 Reset =nnnn	HOLD/ONOF	-	ONOF	ONOF	ONOF	Alarm Reset – auto reset / manual reset
Alarm1 PwrInter	OFF/ON	-	OFF	OFF	OFF	<b>OFF</b> = Disabled <b>ON</b> = Interrupts power to controller outputs
Alarm1 PwrInhb = nnn	OFF/ON	-	ON	ON	ON	Power Inhibit – suspend alarm until PV enters non-alarm condition
Contact@Alarm1 =nnnn	OPEN/CLOSE	-	CLOSE	CLOSE	CLOSE	Alarm1 Output Configuration (Open or Close for alarm condition)
Alarm/Loop Break	OFF/ON		OFF	OFF	OFF	<b>OFF</b> = Disabled
Prog Ramp/Soak = nnn	OFF/ON	-	OFF	OFF	OFF	<b>ON</b> = Input Sensor value doesn't move when output is @ 100%
Prog Values = nnn	OFF/ON	-	OFF	OFF	OFF	Disable/Enable the Ramp Soak Operation
Status of Prog = nnn	OFF/ON	-	OFF	OFF	OFF	Disable/Enable changing of the 16 segments values
Prog Time Base = nnn	60s/1s	Sec	1s	1s	1s	Disable/Enable R/S Status parameters display in Primary Menu
Seg # Time = nnn	0 to 999	Sec	0	0	0	Time base for each R/S segment
Seg # SetPoint=nnnn	(SPL) to (SPH)	F/C	0	0	0	Ramp Soak Segment Time for indicated segment
Seg # A1 Event = nnn	OFF/ON	-	OFF	OFF	OFF	Ramp Soak Setpoint for indicated segment
Seg # A2 Event = nnn	OFF/ON	-	OFF	OFF	OFF	Ramp Soak Alarm 1 Event for indicated segment
Prog End = nnn	OFF/HOLD/LOOP/SETP	-	OFF	OFF	HOLD	Ramp Soak Alarm 2 Event for indicated segment
						Ramp Soak Program End Task. <b>OFF</b> = system will power off at end of the sequence. <b>HOLD</b> = system will control at last segments setpoint.
						<b>LOOP</b> = system will continuously loop through sequence. <b>SETP</b> = system will control at setpoint prior to sequence.
Alarm 2 Low =nnnnn	(SPL) to (SPH)	F/C	100	100	100	Alarm 2 Low Trip Point Setting. This setting applies in absolute and deviation alarm configuration modes. (Default setting shown is when Alarm2 Mode = ABSL).
Alarm 2 High =nnnnn	(SPL) to (SPH)	F/C	200	200	200	Alarm 2 High Trip Point Setting. This setting applies in absolute and deviation alarm configuration modes. (Default setting shown is when Alarm2 Mode = ASL).
Alarm 2 DeadBnd= nnn	0 to 180	-	5	5	5	Alarm 2 Hysteresis for Process Alarms
AntiRst Windup = nnn	OFF/ON	-	ON	ON	ON	Anti-Reset Windup
PerCent Output = nnn	OFF/ON	-	OFF	OFF	OFF	'ON' allows display of % Output on LCD
Loop Break Time	OFF to 9999 sec.	Sec.	OFF	OFF	OFF	Time for input sensor fail.
Analog Output=nnnnn	0-20mA,4-20mA, 0-5V,1-5V,0-10V,2-10V	-	4-20ma	4-20ma	4-20ma	This Selects the Interface Type and Range for the Analog Output
Process OutLow =nnnn	(SCL) to (SCH)	F/C	0	0	0	Process Output Low value
Process OutHigh=nnnn	(SCL) to (SCH)	F/C	250	550	250	Process Output High value
Process Out Src=nnnn	PROC/SETP/FLOW	-	PROC	PROC	PROC	Process Output Source Select – process / setpoint / flow
Heat Output =nnnn	0-20ma,4-20ma, 1-5V,0-5V,0-10V,2-10V	-	4-20ma	4-20ma	4-20ma	Selects the Interface Type and Range for the Heat Output Option Card

**Secondary Menu Parameter Table Continued**

<i>LCD Text Message</i>	<i>Range</i>	<i>Units</i>	<i>Presets Water</i>	<i>Presets Oil</i>	<i>Presets Chiller</i>	<i>Parameter Description</i>
Cool Output = nnnn	0-20ma, 4-20ma, 0-5V, 1-5V, 0-10V, 2-10V	-	4-20ma	4-20ma	4-20ma	Selects the Interface Type and Range for the Cool Output Option Card
Remote Input = nnnn	OFF, SETP, FLOW	-	OFF	OFF	OFF	Selects the Function of the Remote Input
Remote Signal = nnn	0-20ma, 4-20ma, 0-5V, 1-5V, 0-10V, 2-10V	-	4-20ma	4-20ma	4-20ma	Selects the Interface Type and the rang for the Analog Input
Remote SetPtLo = nnn	(SCL) to (SCH)	-	0	0	0	Remote Set Point Low value
Remote SetPtHi = nnn	(SCL) to (SCH)	-	250	550	250	Remote Set Point High value
Remote FlowSLo = nnn	-999 to +999	-	0	0	0	Flow Scale Low when Remote Input is used as Flow
Remote FlowSHi = nnn	-999 to +999	-	100	100	100	Flow Scale High when Remote Input is used as Flow
Flow Display = xxx	GPM / LPM	-	GPM	GPM	GPM	Flow Units – Gallons per minute or Liters per minute
Peak PV = ###	###	F/C	-	-	-	Status parameter indicating the highest process temperature. Pressing the ENTER key while this parameter is displayed will cause the current process temperature to be saved as this value.
Valley PV = ###	###	F/C	-	-	-	Status parameter indicating the lowest process temperature. Pressing the ENTER key while this parameter is displayed will cause the current process temperature to be saved as this value.
Comm. Local/Remote	LOC/RMT	-	LOC	LOC	LOC	<b>Local</b> = Communications OFF. <b>RMT</b> = Communications Enabled



### Secure Menu Parameter Table

<i>LCD Text Message</i>	<i>Range</i>	<i>Units</i>	<i>Presets Water</i>	<i>Presets Oil</i>	<i>Presets Chiller</i>	<i>Parameter Description</i>
Security Level = nnn	0 to 999	-	3	3	3	Refer to the section on 'Changing the Security Level'
Unit Function = nnnnn	HEATLO/HEATHI/CHL LER	-	HEATL O	HEAT HI	CHILLE R	Selects the Unit Function. There are three types of applications, Water, Oil, and Chiller. The Water unit has Functions at Systems Level that detect pump and level status different from Oil Units. Refer to the section on 'Defaulting the controller'.
Tune% Reduction = nnn	OFF/1 to 100	-	15	15	15	Adjusts the Autotune Duty percentage
Mold Offset	± 500° F/C	F/C	0	0	0	Input Sensor Offset Value to change Display to agree with External Reference
Return Offset	± 500° F/C	F/C	0	0	0	
Delivery Offset	± 500° F/C	F/C	0	0	0	
Shutdown Temp	90°-150°	F/C	150	150	-	Adjusts the Shutdown Temperature Setpoint
Sensor Filter = nnn	OFF/1 to 99	-	3	3	3	Sensor Filter value
Display Filter = nnn	OFF/1 to 99	-	3	3	3	Display Filter value
SetPoint Source = nnn	AUT/SP1/SP2	-	AUT	AUT	AUT	Function Select – auto / set point 1 / set point 2
Link Terms	OFF/ON		ON	ON	ON	Shares Integral and Derivative terms for Heat and Cool Outputs.
Approach Rate = nnn	OFF/1 to 99	Min	OFF	OFF	OFF	Time, in minutes, that it will take to get to a new setpoint change. MUST POWER-OFF THEN POWER-ON TO ACTIVATE.
Sensor Monitor = nnnn	OFF/MON/CTRL	-	OFF	OFF	OFF	'OFF' = normal Delivery probe PID control, Delivery probe display. 'MON' = normal Delivery probe PID control, Mold probe display. 'CTRL' = cascade Mold probe PID control, Mold probe display
Flow Monitor = nnn	OFF/PUL/CUR	-	OFF	OFF	OFF	'OFF' = no flow value is displayed on LCD line. 'PUL' = flow is measured in pulses, value is displayed on LCD line. 'CUR' = flow is measured in current, value is displayed on LCD line
Flow Constant B = nnnn	-999 to +999	-	0	0	0	Offset of the Displayed Flow Reading
Flow Constant K = nnnn	-999 to +999	-	1	0	0	Flow sensor Scaling (K Factor or Pulses/Gallon)
Flow Filter = nnn	OFF/1 to 100	-	2	2	2	Flow Filter value
Safety Thermo = nnn	OFF/ON	-	ON	ON	ON	Disable/Enable monitoring for a Safety Thermo error
PressLevel Inp = nnn	Pres/LV/LALR/LVLCNT	-	PRES	PRES	LEVL	Pressure Select – pressure / level alarm / level control
PressLevel = nnn	OFF/ON	-	ON	ON	ON	Pressure Input – off / on
Pressure Timer = nnn	OFF, 1 to 10	Sec	OFF	1	OFF	Pressure Timer value
SP2/RmtStart = nnn	OFF/SP2/RStr	-	SP2	SP2	SP2	Function Select – off / set point 2 / remote start
HighLevelInp = nnn	OFF/LvHi/LvLo	-	OFF	LvLo	LvHi	Level Select – off / high / low
Weld Cont. Inp = nnn	OFF/ON	-	ON	ON	ON	Disable/Enable monitoring for a Weld Contact error
Sensor Type = nnn	J/K/RTD/RTDIK	-	RTDIK	RTDIK	RTDIK	Selection for type of sensor being used for delivery/return temp
MoldSensorType = nnnn	J/K/RTD/RTDIK	-	J	J	J	Selection for type of sensor being used for mold temp
Input Fault Timer	OFF – 1 – 500	Min.	OFF	OFF	OFF	Input out of Range, Shorted, or Open; the timer starts. When time has elapsed the controller reverts to a safe condition.
Out1 Type = nnnnn	1-80S	Sec	10s	10s	10s	Selects the Output 1 Cycle time in seconds
Out2 Type = nnnnn	1-80S	Sec	8s	8s	8s	Selects the Output 2 Cycle time in seconds

Secure Menu Parameter Table <i>Continued</i>						
LCD Text Message	Range	Units	Presets Water	Presets Oil	Presets Chiller	Parameter Description
SetPtLoLimit =nnnn	-30 to 650	-	0	0	32	Sets the lowest value allowed for the setpoint
SetPtHiLimit =nnnn	-30 to 650	-	250	550	65	Sets the highest value allowed for the setpoint
Output 1 Dir/REV		-	REV	REV	REV	Reverse Acting Heat out.
Output 1 Low Limit	0-100% Not > Out high	-	0	0	0	Limits the lowest output
Output 1 High Limit	0-100% Not < Out low	-	100	100	100	Limits the highest output
Absolute/Deviate		-	ABSL	ABSL	ABSL	Absolute setpoint value
Output 2 Dir/REV		-	DIR	DIR	DIR	Direct Acting Cool output
Output 2 Low Limit	0-100% Not > Out high	-	0	0	0	Limits the lowest output
Output 2 High Limit	0-100% Not < Out low	-	100	100	100	Limits the highest output
Alarm2 Cfg =nnnn	OFF/LOW/HIGH/HIHL/EVNT	-	OFF	OFF	OFF	Selects the Alarm 2 Configuration mode
Alarm2 Mode =nnnn	ABSL/DEVI	-	DEVI	DEVI	DEVI	Selects Absolute or Deviation for Alarm 2
Alarm2 Reset =nnnn	HOLD/ONOF	-	ONOF	ONOF	ONOF	Alarm Reset – auto reset / manual reset
Alarm2 PwrInhb =nnnn	OFF/ON	-	ON	ON	ON	Power Inhibit – suspend alarm until PV enters non-alarm condition
Contact@Alarm2=nnnn	OPEN/CLOSE	-	CLOSE	CLOSE	CLOSE	Alarm2 Output Configuration (Open or Close for alarm condition)
ElapsedTimeMode= nnn	OFF/ON/RST	-	ON	ON	ON	Enables/Disables elapsed time meter, or Clears time value to zero
Comm Protocol = nnn	MOD/SPI	-	MOD	MOD	MOD	Selects either Modbus comm protocol or SPI comm protocol
Comm Addr(Hex) =nnnn	0001 to 03E7	-	0001	0001	0001	Selects the comm address, pool = modbus, 20H = SPI
Comm Baud Rate =nnnn	300/1200/2400/4800/9600/19K2/ 28K8/38K4/57K6	-	19K2	19K2	19K2	Selects the comm baud rate
Debug	OFF, 1, 2	-	OFF	OFF	OFF	Diagnostic tool for troubleshooting communication and flow input. <b>1</b> = Communications activity <b>2</b> = Flow Frequency



## 7-4 *Technical Assistance*

### Parts and Service Department

The ACS Customer Service Group will provide your company with genuine OEM quality parts manufactured to engineering design specifications, which will maximize your equipment's performance and efficiency. To assist in expediting your phone or fax order, please have the model and serial number of your unit when you contact us. A customer replacement parts list is included in this manual for your convenience. ACS welcomes inquiries on all your parts needs and is dedicated to providing excellent customer service.

#### For immediate assistance, please contact:

- North, Central and South America, 8am – 5pm CST +1 (800) 483-3919 for drying, conveying, heating and cooling and automation. For size reduction: +1 (800) 229-2919.  
North America, emergencies after 5pm CST (847) 439-5855  
**North America email: [acsuscanadacustserv@corpemail.com](mailto:acsuscanadacustserv@corpemail.com)**
- Mexico, Central & South America  
**Email: [acslatinamericacustserv@corpemail.com](mailto:acslatinamericacustserv@corpemail.com)**
- Europe, Middle East & Africa +48 22 390 9720  
**Email: [acseuropecustserv@corpemail.com](mailto:acseuropecustserv@corpemail.com)**
- India +91 21 35329112  
**Email: [acsindiacustserv@corpemail.com](mailto:acsindiacustserv@corpemail.com)**
- Asia/Australia +86 512 8717 1919  
**Email: [acsasiacustserv@corpemail.com](mailto:acsasiacustserv@corpemail.com)**

### Sales and Contracting Department

Our products are sold by a worldwide network of independent sales representatives. Contact our Sales Department for the name of the sales representative nearest you.

Let us install your system. The Contract Department offers any or all of these services: project planning; system packages including drawings; equipment, labor, and construction materials; and union or non-union installations.

#### For assistance with your sales or system contracting needs please Call:

North, Central and South America +1 (262) 641-8600 or +1 (847) 273-7700  
Monday–Friday, 8am–5pm CST

- Europe/Middle East/Africa +48 22 390 9720
- India +91 21 35329112
- Asia/Australia +86 512 8717 1919

#### Facilities:

ACS offers facilities around the world to service you no matter where you are located. For more information, please visit us at [www.acscorporate.com](http://www.acscorporate.com)

##### United States:

#### ACS Schaumburg-Corporate Offices

1100 E. Woodfield Road  
Suite 588  
Schaumburg, IL 60173  
Phone: + 1 847 273 7700  
Fax: + 1 847 273 7804

#### ACS New Berlin-Manufacturing Facility

2900 S. 160<sup>th</sup> Street  
New Berlin, WI 53151  
Phone : +1 262 641 8600  
Fax: + 1 262 641 8653

##### Asia/Australia:

#### ACS Suzhou

109 Xingpu Road SIP  
Suzhou, China 215126  
Phone: + 86 8717 1919  
Fax: +86 512 8717 1916

##### Europe/Middle East/Africa:

#### ACS Warsaw

Ul. Działkowa 115  
02-234 Warszawa  
Phone: + 48 22 390 9720  
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##### India

#### ACS India

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Mhalunge, Chakan, Tal Khed,  
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